California High-Speed Train Project

Request for Proposal for Design-Build Services

RFP No.: HSR 11-16
Geotechnical Data Report
Clinton Ave to Veterans Blvd

Prepared for

CALIFORNIA High-Speed Rail Authority

GEOTECHNICAL DATA REPORT
PROCUREMENT PACKAGE 1
PROPOSED PRELIMINARY DESIGN
FOR MINIMUM ARRA-FUNDED SEGMENT
CLINTON AVE, FRESNO TO VETERANS BLVD, FRESNO
MERCED-FRESNO SECTION OF THE
CALIFORNIA HIGH-SPEED TRAIN PROJECT

For

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CLINTON AVE, FRESNO TO VETERANS BLVD, FRESNO
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CALIFORNIA HIGH-SPEED TRAIN PROJECT

1.0 EXECUTIVE SUMMARY

The geotechnical data report is prepared in general accordance with California High-Speed Train (CHST) TM 2.9.2 Geotechnical Reports Preparation Guidelines with specific emphasis on providing data only. This summary presents an overview of the geotechnical study performed for Minimum ARRA-Funded Segment within Merced-Fresno Section of the California High-Speed Train Project. It is a 5.5-mile at-grade CHST track from Clinton Avenue to Veterans Boulevard in Fresno, with several new or reconstructed overcrossing/overhead structures.

The purpose of this study was to provide necessary geotechnical data in supporting 30% engineering of the project. However, due to the limitations of available funding at this time and project schedule, the current scope as described in the approved Geotechnical Investigation Work Plan (GIP) cannot meet all the requirements. Therefore, this report should not be considered as a complete "30% Engineering" Document. The assumptions and exceptions to the current Technical Memorandums are presented as an attachment to the GIP.

The following geological and geotechnical considerations were identified:

1. The project site is located in the southeastern portion of the Great Valley geomorphic province, a relatively flat alluvial plain underlain by a thick sequence of sediments in a wide bedrock trough. In general, there is only one mapped geologic unit within the project corridor: Qc-Pleistocene Nonmarine, Alluvial Deposits. The alluvial sediments consist of layers of silty sand, clayey sand, and sandy silt, underlain by poorly graded sand and sandy silt deposited by streams.
2. The proposed corridor is located within the Great Valley seismo-tectonic province, a region of relative seismic quiescence and tectonic inactivity. The active or potentially active faults of most significance to the project are the San Andreas Fault Zone and Ortigalita Fault. Earthquakes originating on both of these faults have caused severe ground shaking at the site in the past and have the potential to do so in the future.

3. The project sits in the lower portion of the asymmetrical Central Valley enclosed by the Sierra Nevada Mountains on the east, the Coast Ranges on the west, the Tehachapi Mountains on the south, and the San Francisco Bay-Delta region on the north. The layer of Pleistocene Corcoran of the Tulare Formation divides the groundwater flow system into an upper semiconfined zone and a lower confined zone. Above the layer of Corcoran Clay, three hydrogeologic units can be identified: Coast Range alluvium (marine), Sierran sand (micaceous), and flood-basin deposits.
4. The geotechnical exploration program conducted for this study included 9 soil borings, in which 5 shallow borings (31.5 feet) were drilled for track study and 4 deep soil borings (111.5~121.5 feet) were drilled for foundation evaluation of bridge/crossing structures. In addition, a seismic CPT was performed for seismic evaluations. Field exploration procedures and laboratory testing program are detailed in Sections 6.0 and 7.0 of the report.
5. Detailed site surface and subsurface conditions, including detailed stratigraphy along the CHST alignment, estimated soil engineering properties based on our review of existing readily available data and our field exploration program are summarized and presented in section 8.0 of this report.

This summary should be used in conjunction with the entire report. It should be recognized that details are not included or fully developed in this section. Therefore, the report must be read in its entirety for a comprehensive understanding of the items contained herein.

2.0 INTRODUCTION

This report presents geotechnical data collected through literature review, field exploration and laboratory testing program conducted for the proposed Minimum ARRA-Funded Segment of the California High-Speed Train (CHST) Project. As indicated on the Project Location Plan, Plate 1, this proposed segment is a 5.5-mile, at-grade CHST track from Clinton Avenue to Veterans Boulevard in Fresno, with several new or reconstructed overcrossing/overhead structures.

2.1 Project Description

The CHST Project involves design and construction of a new high speed rail line connecting northern and southern California via the Central Valley. The initial phase will provide service from San Francisco to Los Angeles and Anaheim. Future extensions will be constructed to Sacramento

and San Diego. The project includes numerous passenger stations as well as various facilities for storage and maintenance of rolling stock and right of way maintenance.

Within the Merced to Fresno Section, more than 60 miles of new rail line, one passenger station, a maintenance-of-way facility, and potentially a heavy maintenance facility (HMF) are planned. There are two primary alignments currently being evaluated. The UPRR/SR 99 Alternative is generally adjacent to the existing transportation corridor defined by the Union Pacific Railroad (UPRR) and State Highway 99 (SR99). The BNSF Alternative is essentially the same as the UPRR/SR 99 Alternative at the north and south ends of the alignment, but veers to the east to follow the BNSF Railroad corridor in the middle. Each of these north-south alignments includes two east-west alignment options for travel to and from the San Francisco Bay Area, one along Avenue 21, and the other along Avenue 24. Wye connection tracks connecting the north-south alignments with the east-west alignments are provided to facilitate direct service between the Bay Area and Merced.

The Merced to Fresno Section of the CHST System would connect the central San Joaquin Valley region to the rest of the statewide CHST System, specifically to: (1) the San Jose to Merced Section via Pacheco Pass; (2) the Merced to Sacramento Section to the north; and (3) the southern Central Valley and Southern California sections of the statewide CHST System. Two north-south alignment alternatives (UPRR/SR99 and BNSF) providing a route between Merced and Fresno. These alternatives would be combined with two east-west alignment alternatives (Avenue 21 and Avenue 24) that provide service to the Bay Area. There is also a Hybrid alternative that combines elements of both north-south alternatives with the Avenue 24 alignment.

For the Merced to Fresno Section, the geotechnical investigations and analyses will be advanced in phases. For the first 5.5 miles from Clinton Avenue to Veterans Boulevard in Fresno, the CHST will be all at-grade with several new or reconstructed roadway overcrossing/overhead structures. The SR 99 freeway will be relocated about 100 feet west of its current alignment from Clinton to Ashlan Avenue, a distance of approximately 2 miles. The existing City of Fresno arterial street overcrossings of the UPRR and SR 99 will have to be modified for the CHST between Clinton and Ashlan Avenues.

As part of the 15% engineering for the Merced to Fresno Section of the CHST project, several preliminary geotechnical studies had been previously conducted by Parikh Consultants, Inc. (PCI).

Two preliminary geotechnical reports had been prepared in June and December 2010, with a 'record set' issue date of May 2011. The first report presents the results of a preliminary geotechnical study for the alignment along UPRR/SR99. The second report focused mainly on the A1-BNSF alignment and Ave 21 and Ave 24 Wye Connections to San Jose.

2.2 Purpose and Scope

The purpose of this study was to provide the necessary geotechnical data to support the 30% engineering of the project. However, due to the limitations of available funding at this time and project schedule, the current scope described in the approved Geotechnical Investigation Work Plan (GIP) cannot meet all of the requirements, and therefore this report should not be considered as a complete "30% Engineering" Document. The assumptions and exceptions to the current Technical Memorandums are presented as an attachment to the GIP.

The geotechnical exploration program conducted for this study is detailed in the following table.

Summary of Geotechnical Exploration Program

Boring ID	Project Element/Purposes	Exploration Type	Approximate Exploration Location	Exploration Depth (ft)	Comments
S0001A	Clinton Avenue Overcrossing Fresno Yard Overcrossing	Soil Boring	STA 2072+50	121.5	2 adjacent structures share one boring
S0002A	CHST Track Study	Soil Boring	STA 2034+00	31.5	
S0003A	CHST Track Study	Soil Boring	STA 2004+00	31.5	
S0004CPT	Seismic Evaluation and Verification	Seismic CPT	STA 1967+50	75	early refusal encountered
S0005A	Ashlan Ave Overhead	Soil Boring	STA 1967+50	121.5	
S0006A	CHST Track Study	Soil Boring	STA 1939+50	31.5	
S0007A	CHST Track Study	Soil Boring	STA 1917+50	31.5	
S0008A	Shaw Ave overcrossing	Soil Boring	STA 1894+50	121.5	
S0009R	Herndon Canal Bridge	Soil Boring	STA 1858+50	111.5	
S0010A	CHST Track Study	Soil Boring	STA 1834+00	31.5	

The geotechnical data report is prepared in general accordance with TM 2.9.2 Geotechnical Reports Preparation Guidelines with specific emphasis on providing data only.

2.3 Available Data and Information

A variety of published and unpublished references related to geotechnical, geologic and seismic conditions along the alignment were reviewed. Other than the geotechnical exploration program outlined above, subsurface information was collected mainly from the following three (3) sources:

1. Logs of Test Borings (LOTBs) in Caltrans As-Built plans for existing bridges along SR 99;
2. LOTBs from Geotracker (http://geotracker.swrcb.ca.gov/). Geotracker is a database and geographic information system (GIS) that provides online access to underground storage tank leak case data.
3. Several geotechnical investigations conducted by PCI and other firms for projects located in the immediate vicinity of the CHST alignment.

Details of the subsurface conditions encountered at each boring location are presented in Appendix A. Where appropriate, data from these explorations have been used to evaluate the subsurface conditions along the alignment.

2.4 Report Organization

This Geotechnical Data Report (GDR) has been prepared generally in accordance with the format outlined in the Geotechnical Reports Preparation Guidelines, R0, TM 2.9.2, which listed elements for typical GDR reports adapted from the primary reference documents by FHWA, Caltrans, and Geotechnical Investigation Guidelines, TM 2.9.1. The assumptions and exceptions to the current Technical Memorandums were presented as an attachment to the approved Geotechnical Investigation Work Plan dated July 28, 2011.

3.0 GEOLOGIC SETTING

3.1 Regional Geology and Soils

The Project Site is located in the southeastern portion of the Great Valley geomorphic province, a relatively flat alluvial plain underlain by a thick sequence of sediments in a wide bedrock trough. The Great Valley is bounded on the west by the South Coast Ranges and on the east by the Sierra Nevada Mountains. Erosion of the South Coast Ranges and the Sierras has produced the sediments

deposited in the Great Valley. Deposition in the valley was mainly marine until the beginning of the Pliocene epoch (approximately 5.3 million years ago) when the Valley's seas retreated beyond the Carquinez Strait and were replaced by freshwater rivers and lakes. Today, the valley is drained by the Sacramento River from the north and the San Joaquin River from the south. Geographically and topographically, the valley has been shaped by the Sacramento and San Joaquin Rivers and their tributaries. The rivers meet approximately 35 miles south of Sacramento (130 miles northwest of Fresno) and discharge through the Sacramento–San Joaquin Delta into San Francisco Bay and the Pacific Ocean.

A series of predominately non-marine Tertiary clastic deposits rest upon granite and metamorphic basement along the eastern margin of the San Joaquin Valley and Cretaceous marine sedimentary rocks at depth beneath the valley. Bedding planes within these sediments generally dip gently southwestward beneath the alluvial deposits which cover most of the valley floor.

The North Merced pediment is an erosional surface of low relief that cuts across a variety of rock types with regional extent and is covered by a thin (usually less than 2 meters thick) deposit of coarse, locally-derived gravel (North Merced Gravel) that appears to have been deposited in a semi-arid climate similar to that of the present. Subsequently, younger deposits were laid down on topography that had been deeply incised into the North Merced surface.

Soil development in these well-drained, relatively uneroded arkosic parent materials of similar grain-size distribution shows several trends with increasing age: (1) increased thickness of horizons and depth to fresh parent material, (2) redder hues, (3) brighter chromas, (4) lower pH, (5) sharper definition of horizon boundaries and more horizons, and (6) sequential development of Cox, AC, cambric B, weak argilitic horizons and finally, a very strong argillitic horizon.

3.2 Local Geology and Soils

General geologic features pertaining to the site were evaluated by reference to the Geologic Map of California: Fresno Sheet: California Division of Mines and Geology, Scale 1:250000 By Matthews, R.A. and Burnett, J.L., 1965. (Refer to Plate 3, Geologic Map for details)

In general, there is only one mapped geologic unit within the project corridor, which is detailed as following:

- Map Symbol: Qc
- Geologic Formation and Formation Subunit: Pleistocene Nonmarine
- Geologic Unit Type: Alluvial Deposits
- Description: No description available.

Based on the preliminary review of existing data and findings of our field exploration program, soils throughout the project corridor are predominately alluvial soils, which is generally consistent with the Geologic Map. Alluvial sediments characteristics are layers of silty sand, clayey sand, and sandy silt, underlain by poorly graded sand (generally derived from erosion of decomposed granite) and sandy silt.

The following soils information is based on the 1971 Soil Survey, Eastern Fresno Area, California (US Department of Agriculture, Soil Conservation Service) and a summary contained in the 2000 General Plan Update for Fresno County.

The Fresno area is underlain by recent alluvial fans and flood plain deposits, young alluvial fans, low alluvial terraces, and high alluvial terraces. These alluvial plains consist of a sequence of deposits washed from the Sierra Nevada Mountains to the east by rivers and streams that flow westward. Many of the alluvial fans that formed have coalesced into broad alluvial aprons with gentle westerly sloping surfaces. The alluvium ranges from new deposits to deposits that are many hundreds of thousands of years old. The recent and young alluvial fans or aprons still retain most, and in some places all, of their original form. The older alluvial fans or aprons retain little of their original shape or size as they have been partially eroded away prior to the subsequent periods of deposition. These older landforms are the alluvial terraces whose forms have been controlled mainly be rivers. Remnants of old fans occur as terraces situated well above the streams that deposited them because of a minor uplift of the area since the deposits were made, downward incision by the streams, and washing away of parts of the deposits.

Most of the soils that underlie the project area are within the San Joaquin-Exeter-Ramona association which have a hardpan cemented by iron and silica that occurs at a depth of 12 to 48 inches and is impermeable to roots and water. All of the soils in this association formed in older granitic alluvium.

The San Joaquin soils have a surface layer of brown to reddish-brown, slightly acid to medium acid loam to sandy loam. They have a thin (about 8 inches) clayey subsoil layer that rests abruptly on a cemented hardpan at a depth of 18 to 36 inches. The hardpan is 6 to 24 inches thick and overlies sandy or silty material. The Exeter soils are similar to the San Joaquin soils, with a slightly finer texture than the surface layer. The Ramona soils are widely distributed in the association within larger areas of hardpan soils. The Ramona soils lack the hardpan but have a compact sandy stratum at a depth of three or four feet which restricts penetration of roots and water somewhat less than does the hardpan.

4.0 SEISMIC SETTING

4.1 Regional Seismicity

The proposed corridor is located within the Great Valley seismo-tectonic province, a region of relative seismic quiescence and tectonic inactivity. This is bounded to the west by the seismically-active central Coast Ranges. The Coast Ranges are traversed by faults of the San Andreas Fault system, including the San Andreas Fault itself, as well as several other active faults. Those faults accommodate the movement between the Pacific and North American tectonic plates, which has been the source of a number of large, damaging earthquakes during historic time.

The Fault Map (Plate 4) shows the approximate position of the major fault zones, and the location of the Project Site in relation to them. The following table (Summary of Major Faults Affecting the Project Site) contains the estimated parameters for earthquakes on several known faults affecting the vicinity.

Summary of Major Faults Affecting the Project Site

Fault Name	**Fault ID**	**Type**	**Mmax**	**Approximate Distance** (mile)
San Andreas Fault Zone	310, 311, 312	RLSS	7.9	65.2
Calaveras fault zone (Paicines Fault)	324	RLSS	7.4	78.3
Calaveras fault zone (Southern Calaveras section)	323	RLSS	7.4	86.1
Sargent Fault (Southeastern section)	405	RLSS	6.8	93.9
Quien Sabe Fault zone	149	RLSS	6.4	75.0
Ortigalita Fault	386, 387, 388, 389	RLSS	7.1	60.1
Owens Valley Fault	392, 391	RLSS	7.6	88.0

4.2 Regional Significant Active Faults

The active or potentially active faults of most significance to the project are the San Andreas Fault Zone and Ortigalita Fault. Earthquakes originating on both of these faults have caused severe ground shaking at the site in the past and have the potential to do so in the future.

San Andreas Fault: The alignment is located approximately 70.3 miles 65.2 northeast of the San Andreas Fault. This fault is the largest active fault in California and extends from the Gulf of California to Cape Mendocino in northern California. The 1906 San Francisco Earthquake originated along the San Andreas Fault and had a magnitude of Mw 7.9. The United States Geological Survey's Working Group (WGCEP, 2003) have estimated the probability of at least one earthquake with magnitude greater or equal to 6.7, occurring along San Andreas Fault before 2031, to be 21%.

Ortigalita Fault: The Ortigalita fault is a 48.8 miles long, north-northwest-striking, right-lateral strike-slip fault located in the southern Diablo Range, 54 miles southwest of the project site. The surface trace of the Ortigalita fault extends from Panoche to southeast of Mount Stakes. The fault consists of two distinct geometric segments, separated by a 3.1-mile (5 KM) wide right-step across San Luis Reservoir. Much of the fault is delineated by persistent micro-seismicity; the fault is marked by numerous indicators of recent strike-slip faulting, such as deflected drainages, shutter ridges, side-hill benches, and vegetation lineaments. The Maximum Credible Earthquake (MCE) for the Ortigalita fault is Mw 7.1, with an effective recurrence of 1100 years.

4.3 Seismic Design Considerations

4.3.1 Seismic Hazards

Fault Rupture: A surface fault rupture occurs when an active fault intercepts and displaces the earth's surface. The State of California has delineated zones around active faults in accordance with the Alquist-Priolo Earthquake Fault Zone Act of 1971 in order to mitigate for the effects of surface faulting. No portion of the project alignment is within a State of California Alquist-Priolo Earthquake Fault Zone, and no active faults are known to cross the project alignment. Therefore, the potential for fault rupture to occur across the alignment is considered low.

Seismic Ground Shaking: During an earthquake, fault movement produces seismic waves that radiate in all directions. Seismic waves can produce strong ground shaking that is typically strongest near the source fault and attenuates as the waves move away from their source. The severity of ground shaking is controlled by the interaction of source magnitude, distance travelled, and the type, thickness, and condition of geologic materials that underlie the site. Unconsolidated, recent alluvium or fill may amplify the amplitude and duration of strong ground motions at sites underlain by those materials.

This potential ground motion value is relatively low compared with more seismically active regions of California. Therefore, strong earthquake ground shaking is not considered to be a significant seismic hazard at the project site. Nevertheless, severe ground shaking could cause structural damages and derailment of moving or stopped trains, possibly resulting in injuries or deaths. Since the consequences of strong ground shaking could be significant, it is recommended that all structures, foundations and embankments must be designed per project specifications for the maximum accelerations estimated based on detailed geotechnical investigations to be conducted during the design phase.

Mitigation measures to reduce the impacts of ground shaking on the project may include ground improvement such as deep soil mixing, jet grouting, soil densification, pile supported structures, etc. The use of specific measures would depend on soil type and stratigraphy.

Liquefaction: Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts with low relative density are the type of soils usually susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

The formations mapped in the project area are Tertiary and Quaternary alluvial deposits. These are likely to contain deposits of sand and silt, which may be potentially liquefiable when saturated. The groundwater in the project site is generally located below 50 feet of the existing ground surface based on the geotechnical data collected. Therefore, the liquefaction potential is considered low along the project alignment. However, higher

groundwater table, such as 35 feet BGS at S0005A and 18 feet BGS at S0009R (for Herndon Canal Bridge), were also encountered during our field exploration. As such, localized higher groundwater tables may exist in some isolated areas. Liquefaction potential should be further evaluated in the final design phase based on more site-specific subsurface information and more detailed geotechnical exploration program.

Lateral Spreading: Lateral spreading is a phenomenon in which lateral ground failure/movement occurs at a site underlain by liquefied soil. It is generally believed that the magnitude of lateral movement of liquefaction-induced lateral spreading will be small at sites that have surface gradients less than about one percent where no free face (an abrupt difference in elevation) is present. Overall, the project site has a low liquefaction potential and relatively flat topography which means minimal cuts and excavation of slopes will be necessary for the project. Therefore, seismically-induced lateral spreading is not considered a potential hazard along most of the project alignment.

Slope Instability: Stability of slopes depends on steepness of the slope, strength of the underlying soils, and pore pressures in the soil. The relatively flat terrain along the majority of the alignment minimizes the potential for slope failures to occur. New slopes may be created at the approaches to overcrossing/overhead structures; however, such embankments will generally be made of engineering fills that will include slope stability mitigation measures. In addition, significant excavating, grading, or fill placement during construction could introduce temporary slope stability hazards at bridge sites or elsewhere along the alignment.

4.3.2 Seismic Design Criteria

We understand that Seismic Design criteria and ARS curves are being developed by the PMT/EMT. The Zone 1 Design Spectra by another firm for Merced-Fresno Segment are included in the appendix for preliminary evaluation. These Design Spectra will be updated by others based on findings of this geotechnical exploration program and laboratory test results.

5.0 HYDROGEOLOGIC SETTING

5.1 Regional Hydrogeologic Cross-Sections

The City of Fresno sits in the San Joaquin Valley, the lower portion of the asymmetrical Central Valley enclosed by the Sierra Nevada Mountains on the east, the Coast Ranges on the west, the Tehachapi Mountains on the south, and the San Francisco Bay-Delta region on the north. The layer of Pleistocene Corcoran of the Tulare Formation divides the groundwater flow system into an upper semiconfined zone and a lower confined zone. Above the layer of Corcoran Clay, three hydrogeologic units can be identified: Coast Range alluvium (marine), Sierran sand (micaceous), and flood-basin deposits. Refer to Schematic Hydrogeologic Cross-Section (Plate 5) for a schematic hydrogeologic cross-section of the Fresno area.

5.2 Major Aquitards

As shown on the Regional Aquifer System, Plate 6, two concepts of the aquifer system have been developed for Central Valley, California, based on the role of the fine-grained lenses on regional flow.

When describing the aquifers in Central Valley, it has been traditional to regard the San Joaquin Valley basin as having an upper unconfined aquifer, an intervening aquitard (the Corcoran Clay), and a lower confined aquifer. This simplified conception has been considered adequate for general description purposes.

Williamson et al. (1989) have convincingly argued that when the Central Valley aquifer system is examined at the regional scale, the Corcoran Clay Member is less important than the combined effect of the fine-grained lenses in controlling vertical flow. The continental deposits of the Central Valley form is actually a single heterogeneous aquifer system, in which lateral and vertical differences in hydraulic conductivity lead to local variations in the degree of aquifer confinement. Consequently, it is not a surprise to find only trivial head differences across the Corcoran Clay in west Fresno County, but up to several hundred feet difference across some of the minor clay lenses in Kings County. Regardless of the role of the lenses of Corcoran Clay in the physical flow system, the contrasts in water chemistry above and below the clay make it an important marker in any study of groundwater quality.

5.3 Regional Groundwater Levels

According to the published information (http://en.wikipedia.org/wiki/), the average elevations are approximately 296 feet (90 M) above mean sea level in Fresno area. Based on the USGS Water-Resources Investigation Report 97-4205, the groundwater table is approximately at elevation 240 feet at the project site, which means that groundwater is generally below 50 feet of the land surface in the project area. This coincides roughly with the findings of our field exploration program and review of other existing geotechnical data in the project area. Refer to Plate 7, General Groundwater Conditions for more details.

However, as indicated in our soil boring logs, localized higher groundwater tables, such as 35 feet BGS at S0005A and 18 feet BGS at S0009R (for Herndon Canal Bridge), were also encountered during our field exploration. It should be noted that groundwater levels tend to fluctuate with seasonal and climatic variations, as well as with local irrigation and construction activities. As such, the possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. The groundwater table should be checked prior to construction to assess its effects on site work and other construction activities.

5.4 Land Subsidence

Subsidence results from consolidation of porous sediments under heavy load. Subsidence is currently occurring in the project area as a result of loading by sediments that originated from erosion and glacial transport from the Sierra Nevada. However, this subsidence is very gradual and occurs over an extremely long period of time relative to the project life. In general, subsidence due to rapid sedimentation is not considered a likely mechanism for triggering subsidence along the project alignment based on the regional geology. Therefore, subsidence is not considered to be a hazard along the project alignment.

Subsidence due to oxidation or dewatering organic-rich soil is not expected to be a problem along the project alignment since there are no significant thicknesses of organic-rich sediments present beneath it.

Collapse of subsurface cavities in underlying soils or bedrock can result in localized areas of

subsidence. The sediments and rocks that comprise the various Tertiary and Quaternary stratigraphic along the project alignment are sands, silts and clays. These deposits are not known to contain cavities that could collapse and result in surface subsidence.

Subsidence can also result from construction activities, such as withdrawal of water from the subsurface soils and placement of loads such as mass fill and new heavy structures. The magnitude of such subsidence and its location should be evaluated during the final design phase. Subsidence due to groundwater withdrawal has occurred in the past in the San Joaquin Valley and continues in some localities today. However, areas that are known to have this type of subsidence are well to the south and east of the project site and it is not considered a potential hazard to the project. Changes in groundwater use within and adjacent to the site in the future may result in potential subsidence.

6.0 FIELD INVESTIGATIONS

This section describes the general field operations and procedures adopted during the geotechnical field exploration program that comprise of exploratory borings and Cone Penetration Test (CPT).

6.1 Introductions

6.1.1 15% Designs

No field geotechnical exploration was conducted during 15% design phases. Geotechnical reports prepared for 15% engineering by PCI are based on the data collected through sources described in Section 2.3 of this report.

6.1.2 Organizations of Team

The field exploration team consists of field engineers and geologists from PCI and drilling crew of Technicon Engineering Services, Inc. from Fresno, CA. All field activities were recorded and summarized in the Daily Field Report by the field engineer and reviewed by the project manager of PCI. Gregg Drilling & Testing, Inc. participated on the team to perform the Seismic CPT for this project.

6.1.3 Field Manual

All field activities were controlled by the approved Geotechnical Investigation Work Plan and Site-Specific Health and Safety Plan prepared for the CHST project by PCI. Copies of both field manuals were with the PCI's field engineer/geologist all the time during the course of the field exploration.

6.1.4 Project Restrictions

All proposed boring and CPT locations for this study are located within the project limits in Fresno. Soil boring and other necessary encroachment permits for the subsurface exploration and field testing program were obtained by PCI from Caltrans and the City as applicable, prior to exploration. The program was intended to include all proposed explorations within the public right-of-way as it was not expected that private access would be provided.

Some proposed borings were drilled on or near rural roads, city streets and Caltrans (Hwy 99) corridor. To minimize disruption of vehicular traffic, the exploration locations were selected, wherever possible, so that most work can be completed outside of the traveled roadways (e.g., in side streets and shoulder areas).

6.2 Exploratory Boring Program

6.2.1 Overview

The exploratory boring program planned for this study included 9 soil borings, in which 5 shallow borings (30 feet) are designed for track study and 4 deep soil borings (100~120 feet) are designed for foundation evaluation of bridge/crossing structures. Boring locations are indicated on the Exploration Location Plan, Plate 2. More details are presented in the table in section 2.2 of this report.

6.2.2 Drill Rig and Hammer Types

Borings were drilled with a truck-mounted drill rig using hollow stem auger and rotary

wash techniques, depending on subsurface conditions. Bentonite was used as the additive to water to create the drilling mud when using the rotary wash drilling techniques. Automatic SPT hammers with proper energy calibration were used for sampling.

6.2.3 Sampling Methods and Equipment

Soils were sampled either by drive sampling or push sampling. When a hammer is used to drive the sampler, the following information was recorded: delivery system; sampler size; whether or not inner brass tubes were used; and blow counts (recorded in 6-inch intervals). Automatic SPT hammers were used when driving samplers and measuring blow counts. When push sampling is used to advance Shelby or Pitcher tube, size and maximum downfeed pressure (read from gauges on the drill rig) are recorded. In all cases, the amount of sample recovery was noted on boring logs.

Typically, the first sample of each boring was taken at a depth of 1 to 3 feet below the ground surface, and then sampling was done at 5-foot intervals throughout the total depth of the boring. To the extent possible, modified California Samplers (2 ½ inch ID, 3 inch OD, with liners) and/or Shelby tubes (3 inch OD) were used to sample cohesive soils. The standard penetration sampler (1.375 inch ID, 2 inch OD, without liners) and/or Pitcher barrel samplers were used in cohesionless soils.

Modified California drive and Standard Penetration Test (SPT) samplers were driven into the soil with a 140 lb automatic trip hammer falling 30 inches in general accordance with ASTM 1586. We require that the automatic hammers be calibrated on a regular basis by the drilling companies. The efficiency factor of the specific hammer system is recorded in the logs. This should provide more realistic data from the drive samples. The sampler is driven 18 inches or to “refusal” (50 blows for less than 6 inches penetration). The blow counts for the final 12 inches of the drive, or portion thereof, are recorded in the field logs.

6.2.4 Handheld Field Tests

Torvane was used to determine undrained shear strength in the field on selected clay samples. Torvane is a handheld device with a calibrated spring. In the field, the Torvane can be pushed into the clay samples and then rotated until the soil fails. The undrained

shear strength is read at the top of the calibrated dial gage and recorded in the field boring logs.

As a general field safety and health procedure, during intrusive activities or anytime site conditions change, volatile organic concentrations in the breathing zone was monitored by the field engineer using a Photo Ionization Detector (PID). A Lower Explosive Limit/Oxygen (LEL/O2) meter was also used for monitoring. The results were noted in the field boring logs.

6.2.5 Groundwater Level Measurements

Groundwater table was measured using a groundwater indicator when encountered during drilling. All borings that were required by the permit were backfilled immediately with cement grout upon completion. 24-hour groundwater table reading was not taken for this study due to public ROW and permit restrictions.

6.2.6 Sample Handling

All soil samples collected during field exploration were recorded on field soil boring logs. All samples were properly sealed and clearly labeled with the following information: sample number, boring number, job number, date collected, initials of person collecting the sample. SPT soil sample were sealed and transported in plastic bags. All California samples were transported in an upright position and secured in sample boxes in such a way as to minimize disturbance to the sample. Samples not tested are retained for future use at the PCI office in San Jose, California.

6.2.7 Borehole Completion and Abandonment

All boreholes deeper than 30 feet or those encountering ground water were backfilled with cement grout upon completion as per the permit requirements. Borings that were 30 feet or less in depth were not required to be grouted with cement. Soil cuttings from the drilling operations were collected in 55-gallon drums and temporarily stored in the driller’s yard. Representative samples of the cuttings were taken to a local analytical laboratory for testing. The samples were deemed to be non-hazardous for disposal purposes. The test

results were included in Appendix C of this report. The test report was submitted to the authority for concurrence so that the cuttings could be disposed off to a non-hazardous landfill site.

6.2.8 Standard Penetration Test (SPT)

The Standard Penetration Test (SPT) is an in-situ dynamic penetration test designed to provide information on the subsurface soils' geotechnical engineering properties, which was developed in the United States around 1925. The test procedure is described in the ASTM -D1586.

During field test, a split-barrel sampler is driven from the bottom of a pre-bored hole into the soil by a 140 lb hammer, dropped freely from a height of 0.76 m (30 inches). The diameter of the pre-bored hole varies generally between 60 and 200 mm (2.5~8 inches). The sampler is first driven to a depth of 150 mm (6-inch) below the bottom of the pre-bored hole, then the number of blows needed for the sampler to penetrate each 150 mm (6-inch) up to a depth of 450 mm (18-inch) is recorded. The value recorded for the first round of advance is usually discarded because of fall-in and contamination in the borehole. The second pair of numbers are then combined and reported as a single value for the last 12 inches. This value is reported as the SPT blow count value, commonly termed as N-value. The blow count is used to evaluate engineering properties of soils in many empirical geotechnical engineering formulae. The steel rods with sufficient stiffness are used for driving the sampler.

6.2.9 Extruded Boring Logs

All borings were logged by or under the direct supervision of a Professional Geologist or Professional Engineer registered in the State of California. The field geologist/engineer recorded daily activities and documented significant field observations on a daily field log. The geologist/engineer logged the drill-holes on a field log in accordance with the visual-manual method described in ASTM D 2488 and Caltrans Soil and Rock Logging, Classification, and Presentation Manual (Caltrans 2007). During drilling operations, sample depths were recorded in Imperial units.

All the information in the title block of the boring log was filled out. A hand-held GPS unit was used to record the GPS coordinates of the borehole location upon completion of each boring. The ground surface elevation at the top of borehole was estimated at the time of drilling wherever possible. Formal elevation and location survey by a professional engineering surveyor is not included in the current scope.

6.2.10 SPT Energy Calibration

Three automatic hammers of Technicon Engineering Services, Inc. have been calibrated for this project by GRL Engineers, Inc. The automatic hammers were monitored during sampling events to determine their average energy transfer ratio on July 25 and 26, 2011. The average energy transfer efficiency of all testing events for the hammers located on drill rigs with serial numbers 305315, 306115 and 354074 were 93%, 87% and 92%, respectively. Hammer energy rate for each boring (drill rig) are indicated on individual boring logs.

6.3 Seismic Cone Penetration Testing Program

6.3.1 Equipment

A specially designed CPT truck by Gregg Drilling & Testing, Inc. was used for the Seismic CPT program. The large CPT truck provides: Hydraulic jacking and reaction systems; 25 ton thrust capacity; Advanced computer monitoring and data reporting systems; Climate controlled working space for operators, geologists, and engineers; Stainless steel rig enclosures provide efficient laboratory space; Decontamination sink; Under carriage cameras to aid operator in rig positioning.

This CPT unit has the following advantages:

- Detailed hydrogeologic profiling at an average rate of 400 to 500 feet per day;
- Provides a near continuous log of the site lithology;
- Real-time data enabling an accurate, on-site, lithologic subsurface representation;
- Ideal for sands, silts, clays, soft soils and mine tailings;
- Provides piezometric data in addition to geotechnical design parameters;

- Add-ons such as seismic, resistivity, UVIF and gamma modules provide additional data.

6.3.2 Procedures

Prior to the start of testing, the truck is jacked up and leveled on four pads to provide a stable reaction for the cone thrust. During the test, the instrumented cone is hydraulically pushed into the ground at the rate of about 2 centimeters per second (cm/s), and readings of cone tip resistance, sleeve friction, and pore pressure are digitally recorded every second. As the cone advances, additional cone rods are added such that a "string" of rods continuously advances through the soil. As the test progresses, the CPT operator monitors the cone resistance and its inclinations. Information collected during a push is stored digitally in the computer. The data files include project description and location, operator, data format information, and other pertinent information about the sounding. Following each push, the data collected is presented in a graphical format. The preliminary field log includes: Cone tip resistance plot in tons per square feet (tsf) versus depth; Friction sleeve resistance plot in tsf versus depth; Friction ratio plot in percentage versus depth; Pore pressure in tsf versus depth.

The Seismic Cone Penetration test (SCPT) consists of measuring the travel times of body waves propagating between a wave source and the ground surface and an array of geophones in an in-situ seismic cone penetrometer. These body waves comprise shear waves (S-waves) and compressional or primary pressure waves (P-waves).

The seismic cone penetration test (SCPT) combines the seismic downhole method and the logging capabilities of the cone penetration test (CPT) to provide rapid, reliable and economic means of determining soil stratigraphy, relative density, strength, shear and compressional wave velocities. From interval shear wave velocity and the mass density of a soil layer, the dynamic shear modulus of the soil over a specific interval may be calculated.

6.3.3 Locations

The Seismic CPT (S0004CPT) was advanced at the location near STA 1967+50 as

indicated on the Exploration Location Plan (Plate 2).

6.3.4 CPT Completion and Abandonment

Upon completion of a CPT, the CPT rig was moved off the testing location and the hole was backfilled with grout in accordance with the City requirements using the tremie method.

6.3.5 Dissipation Testing

CPT probe has the ability to perform dissipation test which acquires pore pressure data versus time. At any time during a CPT test, the push can be paused to record pore pressure dissipation as it approaches static equilibrium. One dissipation test was performed at the depth of 71.03 feet in S0004CPT. The test took about 8.3 minutes to complete. Dissipation test data can be used to estimate the compressibility and permeability of the soil strata. It can also sometimes be used to estimate the groundwater table.

6.3.6 Results

The seismic cone penetration test (S0004CPT) report is included in Appendix A of this report. Measured data from cone soundings are presented graphically and/or digitally in terms of the individual readings versus penetration depth, including: cone tip resistance, sleeve friction, and penetration pore pressure, soil classification using CPT data based on empirical charts, SPT N_{60} derived from the CPT data, shear wave velocity measurements, and pore pressure dissipation test results, etc.

7.0 LABORATORY INVESTIGATIONS

Laboratory tests were performed on selected soil samples to assess their index and engineering properties and physical characteristics. Actual number and schedule of tests were decided by the geotechnical engineer based on the field classification of the soils, the geotechnical design parameters needed, and quality of samples recovered.

7.1 Introductions

The following laboratory tests were conducted on selected bulk and relatively undisturbed soil samples. Detailed laboratory soil test results are presented in Appendix B of this report.

- Moisture content and dry unit weight;
- Grain-size distribution of sands and gravels via sieve analysis;
- Grain size distribution of fines via hydrometer analysis;
- Atterberg limits (liquid and plastic limits);
- Direct Shear;
- Unconfined compression;
- Consolidation;
- Consolidated, undrained triaxial;
- Unconsolidated, undrained triaxial;
- Corrosivity;

7.1.1 Laboratory Visual Classification

All soil samples collected during our field exploration were properly sealed and labeled, and transported back to PCI's geotechnical engineering laboratory in San Jose, California. Soil samples were then examined in the laboratory by experienced staff geotechnical engineers or geologists and classified according to the visual-manual method described in ASTM D 2488 and Caltrans Soil and Rock Logging, Classification, and Presentation Manual (Caltrans 2007). These soil descriptions and classifications were further modified by the project engineer based on the laboratory test results and presented in the final LOTBs.

7.1.2 Moisture Content and Unit Weight

Measurements of the moisture content and dry unit weight were performed on selected samples recovered from the borings. These tests were conducted in general accordance with ASTM D 2216 and EM 1110-2-1906. Results of the moisture content and dry unit weight measurements are presented at the corresponding sample locations on the LOTBs in the Appendix.

7.1.3 Sieve and Hydrometer Analysis

Sieve and Hydrometer Analysis were performed to determine the percentage of different grain sizes contained within the soil. The sieve analysis is to determine the distribution of the coarser, larger-sized particles, and the hydrometer method is to determine the distribution of the finer particles. These tests were performed in general accordance with ASTM D 422 on either the entire sample or the portion of the sample retained on the No. 200 sieve.

7.1.4 Materials Finer than No. 200 Sieve

For some samples, only No. 200 sieve wash analysis were needed, which were performed in accordance with ASTM D1140. The percent (by weight) of the portion of the sample finer than the No. 200 sieve obtained from the sieve and sieve wash analyses are presented in the report.

7.1.5 Atterberg Limits

A wide variety of soil engineering properties have been correlated to its liquid and plastic limits. The Atterberg Limits test was conducted in general accordance with ASTM D 4318 on selected fine grained soils to determine their plastic and liquid limits.

7.1.6 Consolidation

Consolidation tests were performed on selected soil samples to evaluate compressibility and time dependent consolidation rates in accordance with ASTM D 2435.

7.2 Specialty Testing

7.2.1 Direct Shear Test

The purpose of the direct shear test is to determine the consolidated-drained shear strength of a cohesionless soil. Direct shear tests were performed on selected samples in general accordance with ASTM D 3080.

7.2.2 Unconfined Compression

The primary purpose of the unconfined compression test is to determine the soil's unconfined compressive strength, which can be used to calculate the unconsolidated undrained shear strength of the clay soils under unconfined conditions. According to the ASTM standard, the unconfined compressive strength (qu) is defined as the compressive stress at which an unconfined cylindrical soil specimen will fail in a simple compression test. In addition, in this test method, the unconfined compressive strength is taken as the maximum load attained per unit area, or the load per unit area at 15% axial strain, whichever occurs first during a test.

Unconfined compression tests were performed on selected clayey soil samples in accordance with ASTM D 2166 - Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.

7.2.3 Triaxial Test

Triaxial Test is a common laboratory testing method widely used for obtaining shear strength parameters for a variety of soil types under drained or undrained condition. It involves subjecting a cylindrical soil sample to radial stresses (confining pressure) and controlled increases in axial stresses or axial displacements.

Consolidated-Undrained triaxial (TCU) tests were performed on selected clayey soil samples to evaluate their total and effective shear strength in accordance with ASTM D 4767.

Unconsolidated-Undrained triaxial (TUU) tests were performed on selected clayey soil samples to evaluate their undrained shear strength in accordance with ASTM D 2850.

7.3 Corrosion Testing

Soil corrosivity tests were performed on selected soil samples to evaluate their corrosion potential towards concrete and ferrous metals. Standard Caltrans tests are pH, laboratory resistivity, sulfate and chloride.

8.0 SITE CONDITIONS

8.1 Surface Conditions and Physical Setting

The current investigation was conducted for the first 5.5 miles CHST track from Clinton Avenue to Veterans Boulevard in Fresno. The site is generally flat with public ROW for drill rig access. The proposed CHST will be all at-grade in this section with several new or reconstructed roadway overcrossing/overhead structures. The SR 99 freeway will be relocated about 100 feet west of its current alignment from Clinton to Ashlan Avenue, a distance of approximately 2 miles. The existing City of Fresno arterial street overcrossings of the UPRR and SR 99 will have to be modified for the CHST between Clinton and Ashlan Avenues.

8.2 Generalized Subsurface Conditions

8.2.1 Geologic Deposits

Based on the preliminary review of existing data and findings of the field exploration program, soils throughout the project corridor are predominately alluvial soils and expected to be generally uniform, especially at foundation depths. The near surface materials could vary depending on its past history of construction. Alluvial sediments characteristics are layers of silty sand, clayey sand, and sandy silt, underlain by poorly graded sand (generally derived from erosion of decomposed granite) and sandy silt.

8.2.2 Applicable Geotechnical Subsurface Information

Detailed subsurface conditions encountered during our field exploration are summarized in section 8.3 of this report. The potential geologic hazards that might exist or need to be discussed in the project area based on the literature search and research of the existing data

include: fault rupture, seismic ground shaking, liquefaction, lateral spreading, slope instability, settlement, collapsible soils, expansive soils, erosion, etc.

8.3 Detailed Stratigraphy along the CHST Alignment

Subsurface stratigraphic cross-section developed using gINT program is included in Appendix A of this report. The following table summarizes the generalized subsurface conditions at each boring location based on the findings of data review, our field exploration program and laboratory test results. Refer to the exploration location plan and LOTBs in Appendix A for more detailed information.

Summary of Subsurface Conditions for Preliminary Evaluation

Boring ID	Subsurface Soil Conditions	Groundwater Table Depth (ft)
S0001A	very dense clayey sand or silty sand with moderate cementation in the upper 5 ft underlain by loose to medium dense silty sand and sand or stiff sandy silt to 28 ft, followed by dense to very dense silty sands and interbedded layers of hard sandy silts or sandy lean clays to 121.5 ft.	115 10/26/2011
S0002A	dense to very dense silty sands with moderate to strong cementation in the upper 8 ft underlain by medium dense silty sands or sands to 31.5 ft.	not encountered 10/31/11
S0003A	dense to very dense silty sands with moderate to strong cementation in the upper 8 ft underlain by loose to medium dense silty sands or sands to 31.5 ft.	not encountered 10/31/11
S0004CPT S0005A	very dense silty sand in the upper 3.5 ft underlain by very stiff lean clay and silt to 13 ft, followed by medium dense to dense silty/clayey sands or sands with interbedded layers of very stiff to hard sandy silts to 51 ft. Materials below 51 feet are generally dense to very dense silty sands and sands with interbedded layers of very stiff to hard silts and clays to 121.5 ft.	35 11/1/2011
S0006A	medium dense to very dense silty sand in the upper 16 ft underlain by interbedded layers of loose sands, very stiff clays and very dense silty sands to 26 ft, followed by hard sandy silts to 31.5 ft.	not encountered 10/31/11
S0007A	very dense silty sands with moderate to strong cementation in the upper 4 ft underlain by medium dense to very dense silty sands or sands to 31.5 ft.	not encountered 10/31/11
S0008A	very dense silty/clayey sands in the upper 6 ft, underlain by stiff to very stiff lean clay and silt to 16.5 ft, followed by dense to very dense silty sands and sands with interbedded layers of very stiff to hard silts and lean clays to 121.5 ft.	105 10/27/2011
S0009R	dense to medium dense silty sand in the upper 15 ft underlain by loose to dense sand to 23 ft, followed by hard silts and lean clays with interbedded layers of dense to very dense silty sands and clayey sands to 111.5 ft.	18 10/28/2011
S0010A	very dense silty sands with moderate to strong cementation in the upper 4 ft underlain by medium dense to very dense silty sands or sands to 31.5 ft.	not encountered 10/31/11

As discussed previously, groundwater is generally below 50 feet of the ground surface in the project area. However, as indicated in the table above, higher groundwater tables, such as 35 feet BGS at S0005A and 18 feet BGS at S0009R (for Herndon Canal Bridge), were also encountered

during our field exploration. We believe these localized relatively shallower groundwater conditions may have significant impact on design and construction of nearby structures and embankments. It should be noted that groundwater levels tend to fluctuate with seasonal and climatic variations, as well as with local irrigation and construction activities. As such, the possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. The groundwater table should be checked prior to construction to assess its effects on site work and other construction activities.

8.4 Geotechnical Properties – Soils

8.4.1 Cohesive Soils

Our field exploration program did not encounter soft clays at the explored locations. The existing data review did not reveal soft clays or other unsuitable soils in the general area as well. The materials encountered in the borings within the upper 120 feet are predominately medium dense to very dense silty sands, sands or sandy silts. Only thin layers of clays or sandy clays were encountered at various depths, mostly with very stiff to hard consistency. Based on this limited investigation, impact of weak cohesive soils on foundation and embankment design and construction should not be a major concern in this section of the CHST project.

The estimated cohesive soil properties based on findings of field exploration program and our laboratory test results are summarized in the following table for preliminary evaluation. More details are presented in soil boring logs and laboratory test results in Appendix A and Appendix B of this report.

Summary of Estimated Cohesive Soil Properties

Soil Properties	Stiff	Very Stiff	Hard
Total Unit Weight (pcf)	110 to 120	120 to 130	130 to 140
SPT Blow Count (N_{60})	9 to 15	15 to30	30 to 50+
Unconfined Compressive Strength (tsf)	1 to 2	2 to 4	>4
Undrained Shear Strength (psf)	1000 to 2000	2000 to 3000	3000 to >4000
Compressibility	medium	low	very low

8.4.2 Cohesionless Soils

The upper 120 feet of soils encountered at the boring locations are predominately medium dense to very dense silty sands, sands or sandy silts. In general, the upper 30 feet of cohesionless soils are medium dense and soils below 30 feet are mainly dense to very dense.

The estimated cohesionless soil properties are summarized in the following table for preliminary evaluation. More details are presented in soil boring logs and laboratory test results in Appendix A and Appendix B of this report.

Summary of Estimated Cohesionless Soil Properties

Soil Properties	Medium Dense	Dense	Very Dense
Total Unit Weight (pcf)	110 to 120	120 to 130	130 to 140
SPT Blow Count (N_{60})	11 to 30	30 to 50	>50
Relative Density (%)	35 to 65	65 to 85	>85
Angle of Internal Friction (deg)	30 to 35	35 to 40	>40

8.4.3 Corrosion Potential

Several parameters influence soil corrosivity, including soil resistivity, degree of saturation, pH level, dissolved salts, redox potential and total acidity. Soil resistivity is a measure of the ability of a soil to conduct electrical current and is usually related to the amount of soluble salts in the soil. Low resistivity generally indicates a more corrosive condition. Another factor influencing corrosion potential is pH level. Soils or water with pH values below pH 7 indicate acidic conditions, and hence, a corrosive environment for metals and concrete. Chloride and sulfate concentrations in soil also can have a corrosive effect on the buried utilities and foundation elements. The following table summarizes the corrosion testing results.

Summary of Corrosion Test Results

Boring	Depth (ft)	pH	Minimum Resistivity (ohms-cm)	Sulfate (ppm)	Chloride (ppm)
S0001A	6	6.31	2600	26.6	40.5
S0002A	6	6.56	5360	0.8	5.4
S0003A	6	7.84	2950	25.8	10.4
S0005A	6	8.16	990	45.4	27.3
S0006A	6	7.83	7500	15.8	14.0
S0007A	6	8.09	3750	15.0	8.2
S0008A	11	7.41	3220	11.9	13.6
S0009R	6	8.88	5900	10.0	6.1
S0010A	6	7.38	13400	0.1	6.0

For reference, per Caltrans Corrosion Guidelines, September 2003, Version 1.0, for structural elements, Caltrans considers a site to be corrosive if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

- Chloride concentration is 500 ppm or greater, sulfate concentration is 2000 ppm or greater, or the pH is 5.5 or less.

Based on the corrosion test results, the subsoils at the referenced boring locations are not considered corrosive per Caltrans corrosion design guidelines. More detailed study should be done during the final design phase to evaluate the soil corrosivity at each structure location. Special considerations and guidelines for foundations and underground facilities in corrosive environments should be included in the design documents. This is an important aspect of the foundation design since structures at some of the locations may require steel piles for foundation support.

9.0 LIMITATIONS

Our services consist of providing professional services in accordance with generally accepted geotechnical engineering principles and practices for the defined scope and are based on our data research and the assumption that the subsurface conditions do not deviate from reported conditions. All work done is in general accordance with the reference TM, and at the direction of the Segment Designer and the EMT/PMT for the overall CHST Program. This report should not be considered as a design level document and as such the scope of investigation, engineering analyses and design discussions are not detail enough to satisfy the requirements for a final Design-Bid-Build or Design-Build Program. This report is neither a Geotechnical Design Report nor a Geotechnical Baseline Report. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during design and construction to attain a properly constructed project. Contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the 30% design of this project. However, due to the limitations of available fund at this time and project schedule, the current scope described in the approved Geotechnical Investigation Work Plan (GIP) cannot meet all of the requirements, and therefore this report should not be considered as a complete "30% Engineering" Document. Additional studies and field investigations are required to refine and/or update the design to a 30% level.

This report is issued with the understanding that it is the Design-Build Contractor's responsibility to ensure that they perform additional investigations as necessary to develop their design. Subsequent investigations and studies could result in significantly different findings for which the author of this report is not responsible or liable.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

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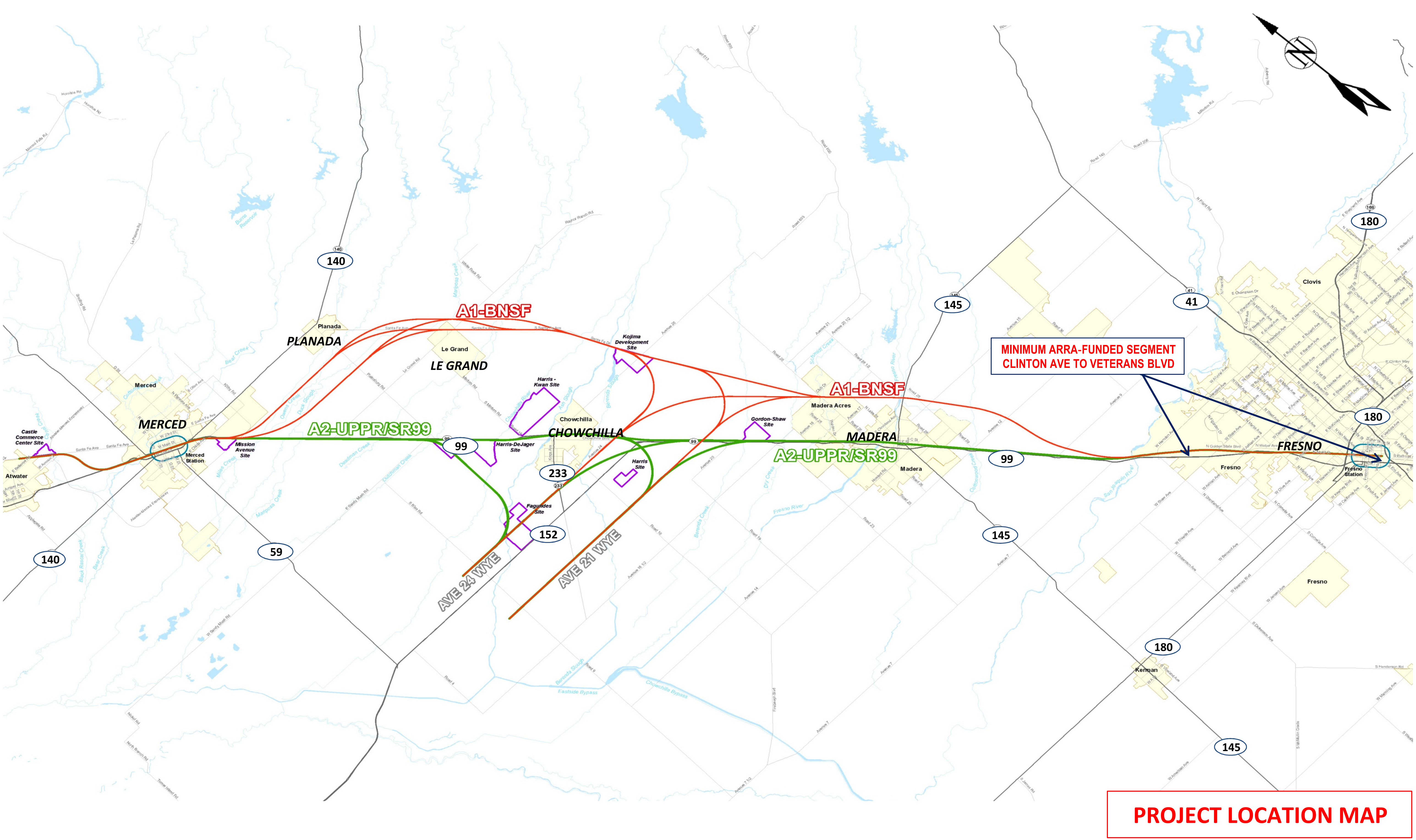


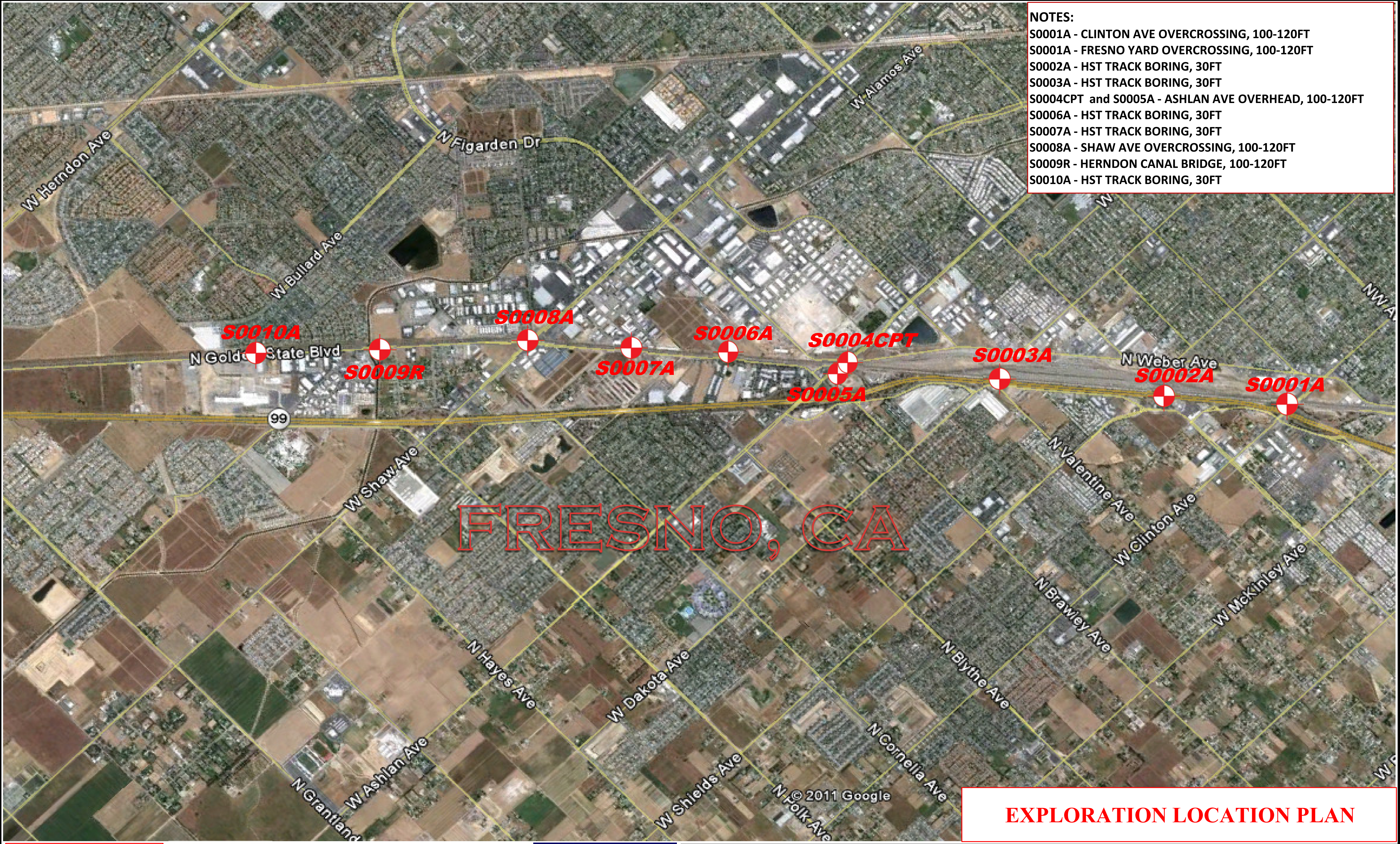
PROJECT LOCATION MAP

FLY CALIFORNIA Without ever leaving the ground.

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH-SPEED TRAIN PROJECT

JOB NO.: 2009-138-400	PLATE NO.: 1



NOTES:

S0001A - CLINTON AVE OVERCROSSING, 100-120FT
S0001A - FRESNO YARD OVERCROSSING, 100-120FT
S0002A - HST TRACK BORING, 30FT
S0003A - HST TRACK BORING, 30FT
S0004CPT and S0005A - ASHLAN AVE OVERHEAD, 100-120FT
S0006A - HST TRACK BORING, 30FT
S0007A - HST TRACK BORING, 30FT
S0008A - SHAW AVE OVERCROSSING, 100-120FT
S0009R - HERNDON CANAL BRIDGE, 100-120FT
S0010A - HST TRACK BORING, 30FT

EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

1.0 mile

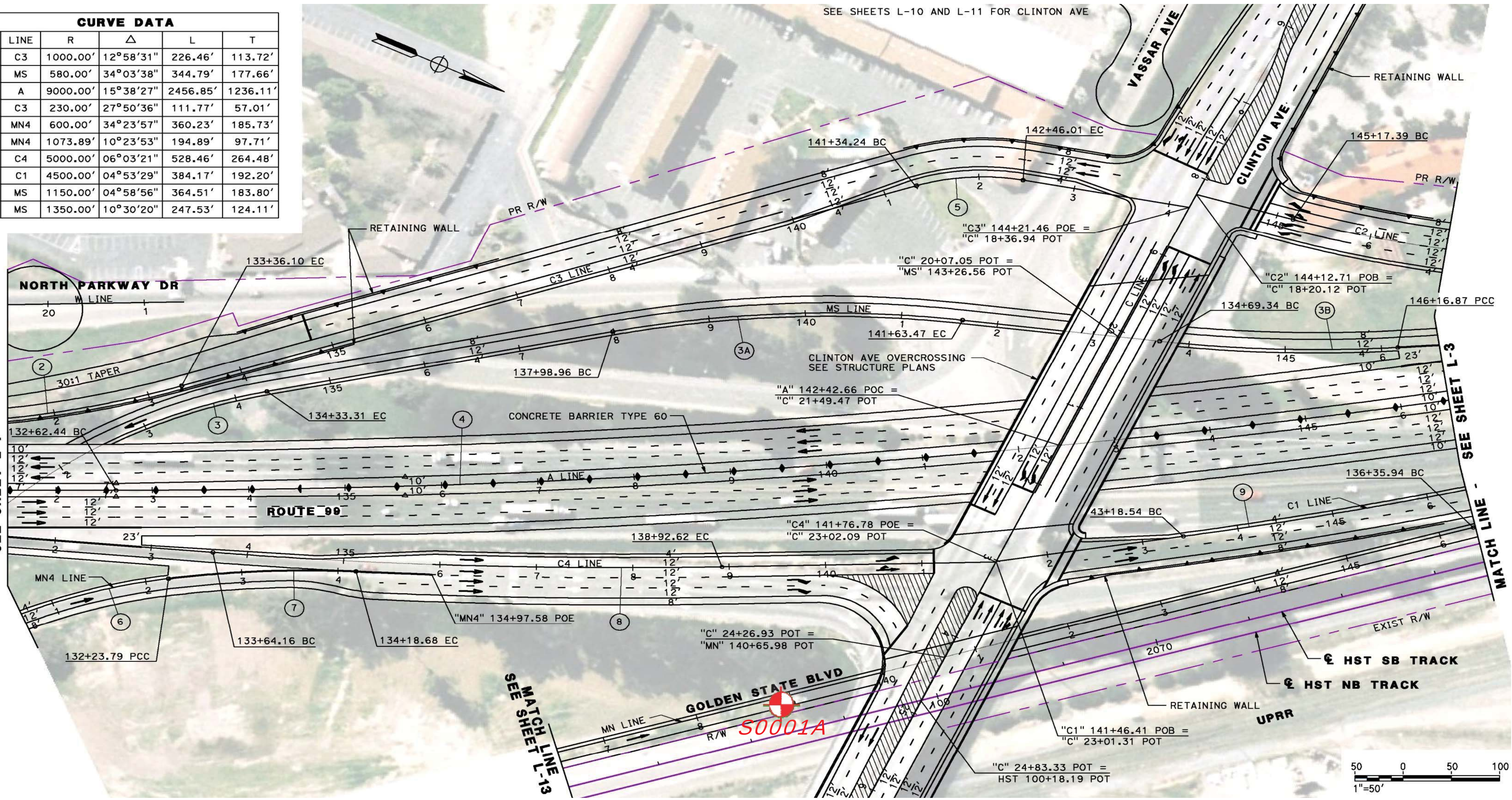
FLY CALIFORNIA Without ever leaving the ground.

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH-SPEED TRAIN PROJECT

JOB NO.: 2009-138-400 PLATE NO.: 2-0

CURVE DATA					
No.	LINE	R	△	L	T
2	C3	1000.00'	12°58'31"	226.46'	113.72'
3	MS	580.00'	34°03'38"	344.79'	177.66'
4	A	9000.00'	15°38'27"	2456.85'	1236.11'
5	C3	230.00'	27°50'36"	111.77'	57.01'
6	MN4	600.00'	34°23'57"	360.23'	185.73'
7	MN4	1073.89'	10°23'53"	194.89'	97.71'
8	C4	5000.00'	06°03'21"	528.46'	264.48'
9	C1	4500.00'	04°53'29"	384.17'	192.20'
3A	MS	1150.00'	04°58'56"	364.51'	183.80'
3B	MS	1350.00'	10°30'20"	247.53'	124.11'



P. Dayah 11/10/11

EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

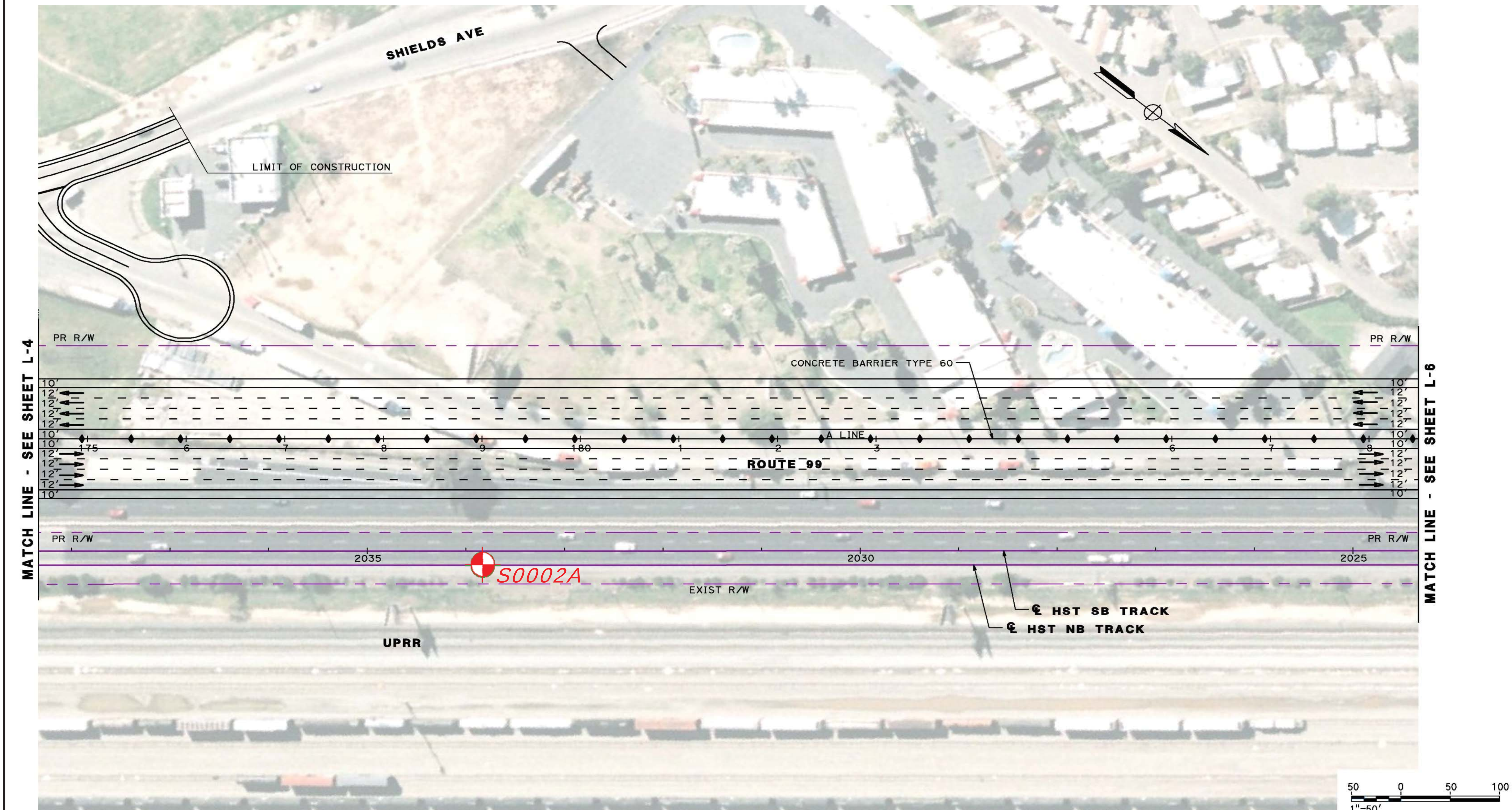
NOTES: THIS EXPLORATION LOCATION PLAN WAS MODIFIED FROM THE RECORD SET 15% DESIGN SUBMITTAL BY AECOM AND CH2MHILL DATED APRIL 29, 2011.

FLY CALIFORNIA Without ever leaving the ground.

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400 PLATE NO.: 2-1



EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

NOTES: THIS EXPLORATION LOCATION PLAN WAS MODIFIED FROM THE RECORD SET 15% DESIGN SUBMITTAL BY AECOM AND CH2MHILL DATED APRIL 29, 2011.

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MATERIALS TESTING

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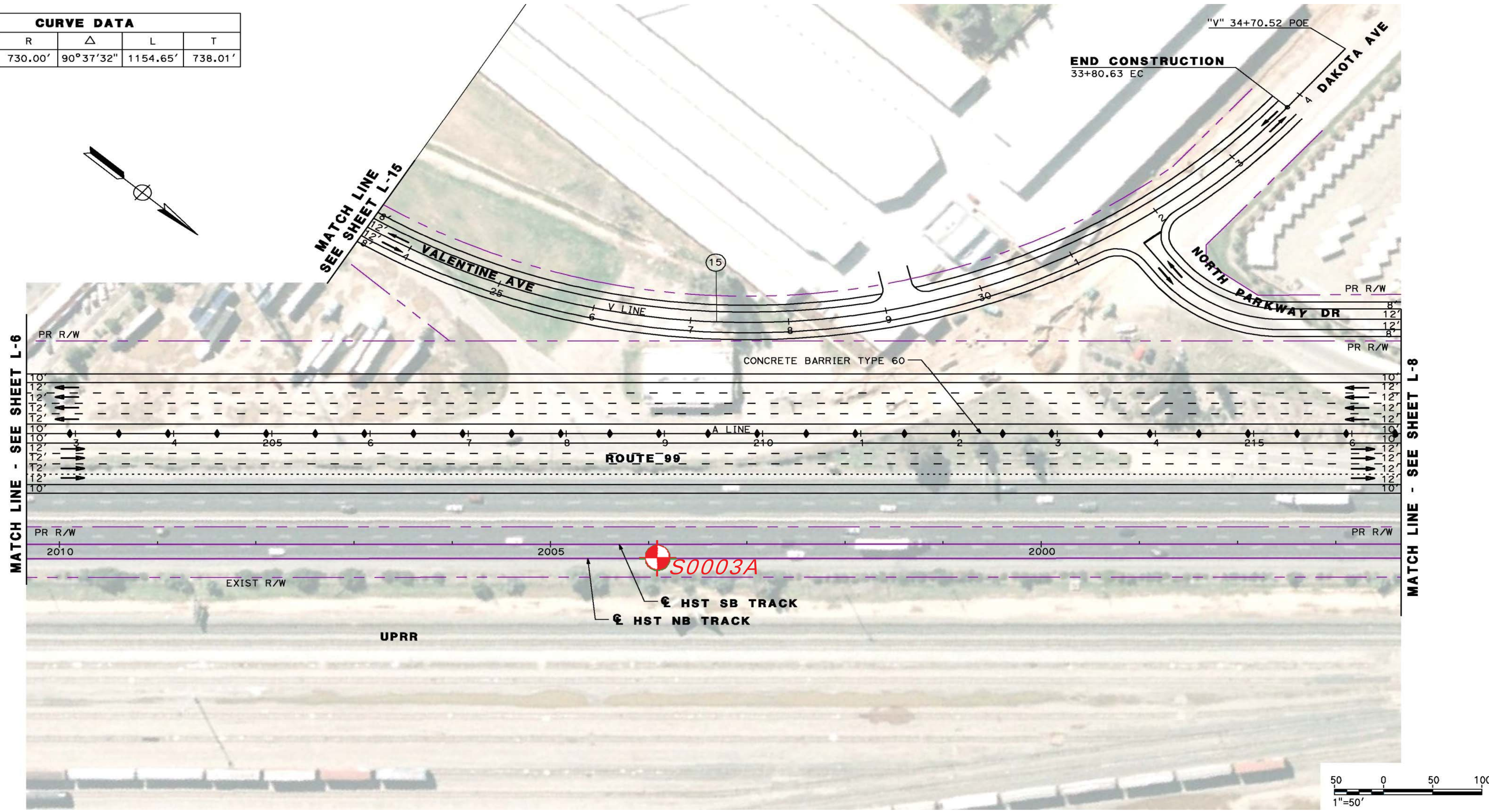
JOB NO.: 2009-138-400 PLATE NO.: 2-2

CURVE DATA					
No.	LINE	R	Δ	L	T
15	V	730.00'	90°37'32"	1154.65'	738.01'



EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

NOTES: THIS EXPLORATION LOCATION PLAN WAS MODIFIED FROM THE RECORD SET 15% DESIGN SUBMITTAL BY AECOM AND CH2MHILL DATED APRIL 29, 2011.

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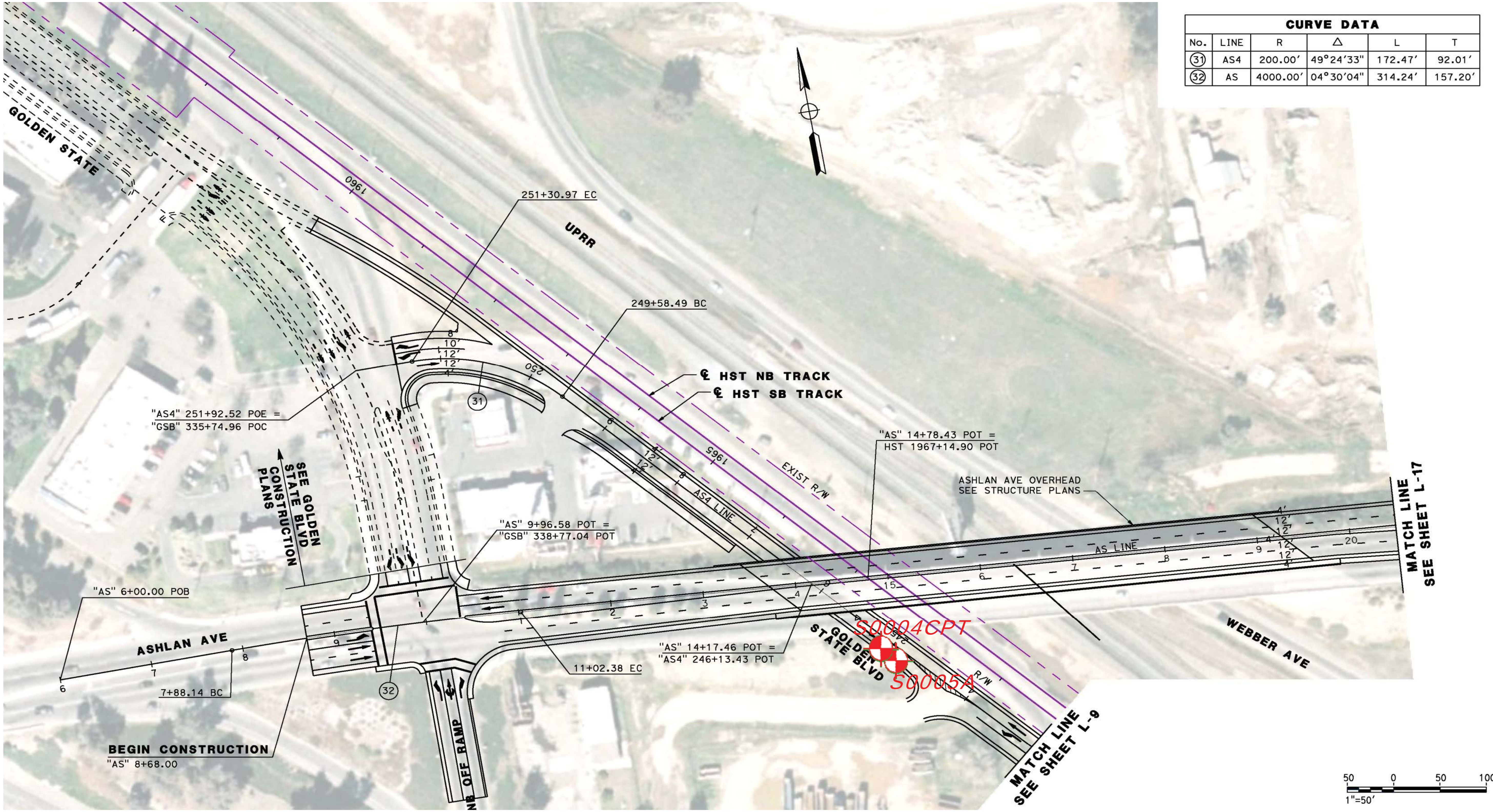
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400 PLATE NO.: 2-3



CURVE DATA

No.	LINE	R	Δ	L	T
31	AS4	200.00'	49°24'33"	172.47'	92.01'
32	AS	4000.00'	04°30'04"	314.24'	157.20'

EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

NOTES: THIS EXPLORATION LOCATION PLAN WAS MODIFIED FROM THE RECORD SET 15% DESIGN SUBMITTAL BY AECOM AND CH2MHILL DATED APRIL 29, 2011.

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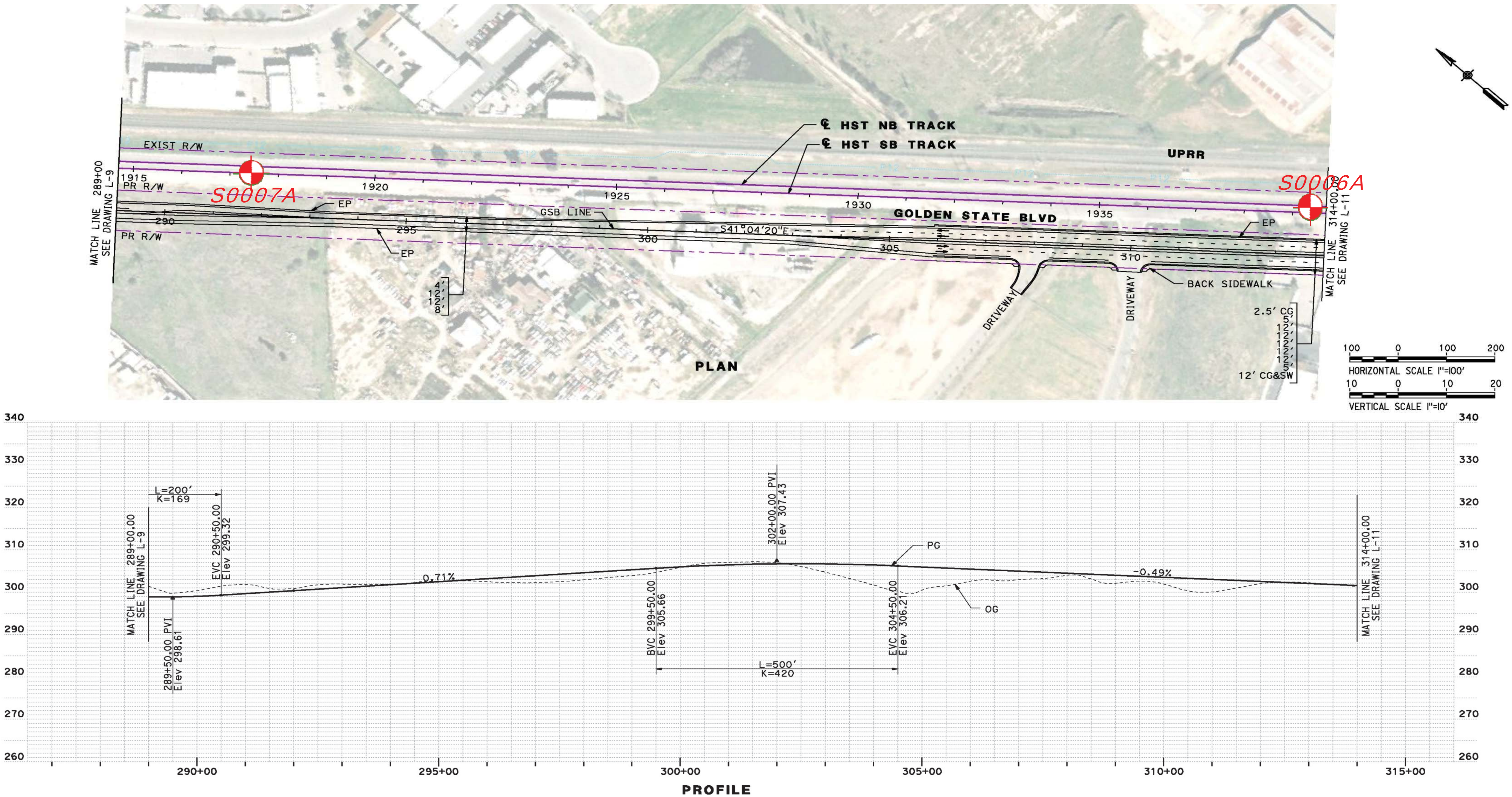
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400

PLATE NO.: 2-4



EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

NOTES: THIS EXPLORATION LOCATION PLAN WAS MODIFIED FROM THE RECORD SET 15% DESIGN SUBMITTAL BY AECOM AND CH2MHILL DATED APRIL 29, 2011.

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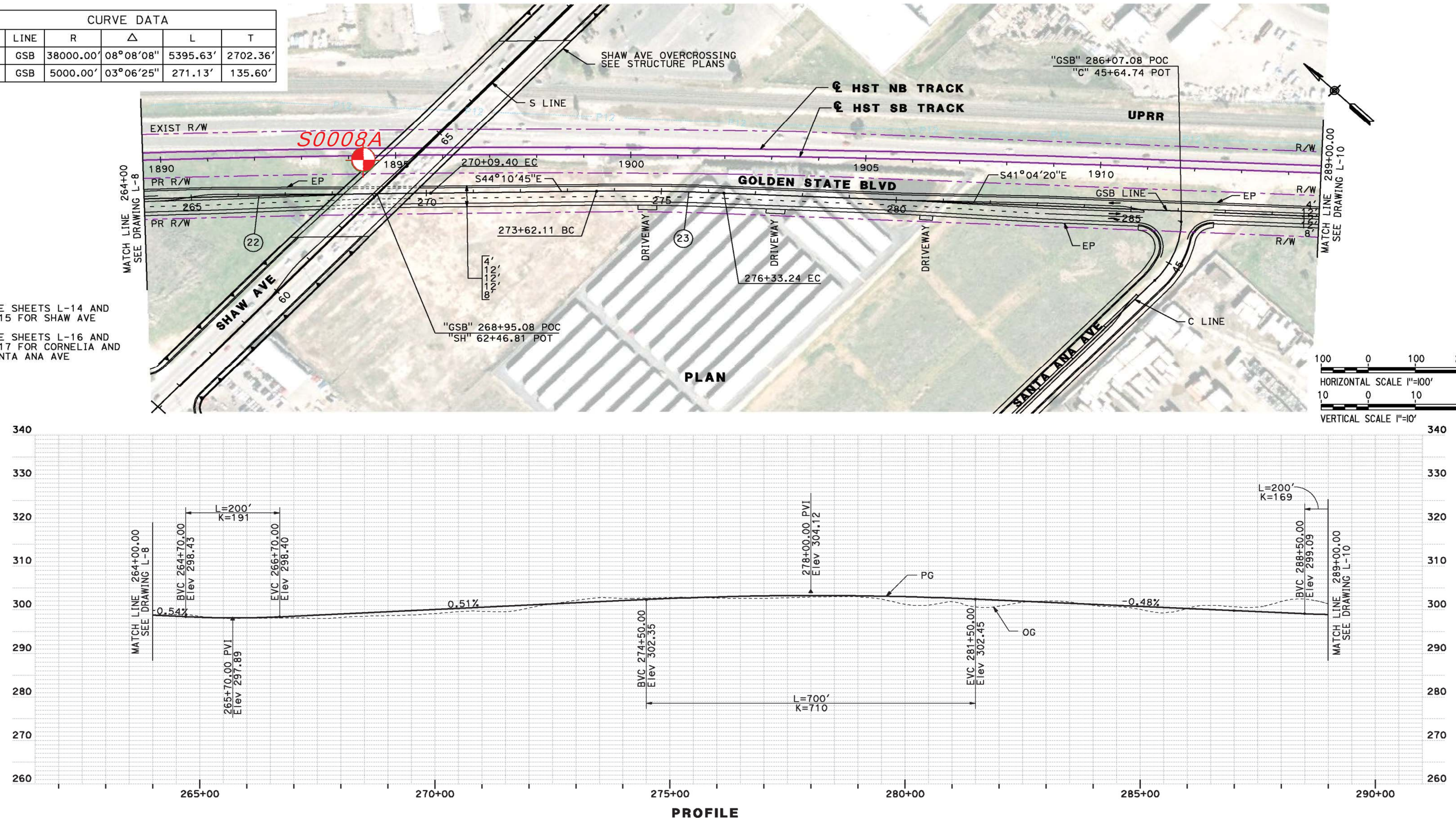
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400 PLATE NO.: 2-5

CURVE DATA					
No.	LINE	R	Δ	L	T
22	GSB	38000.00′	08°08′08″	5395.63′	2702.36′
23	GSB	5000.00′	03°06′25″	271.13′	135.60′



EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

NOTES: THIS EXPLORATION LOCATION PLAN WAS MODIFIED FROM THE RECORD SET 15% DESIGN SUBMITTAL BY AECOM AND CH2MHILL DATED APRIL 29, 2011.

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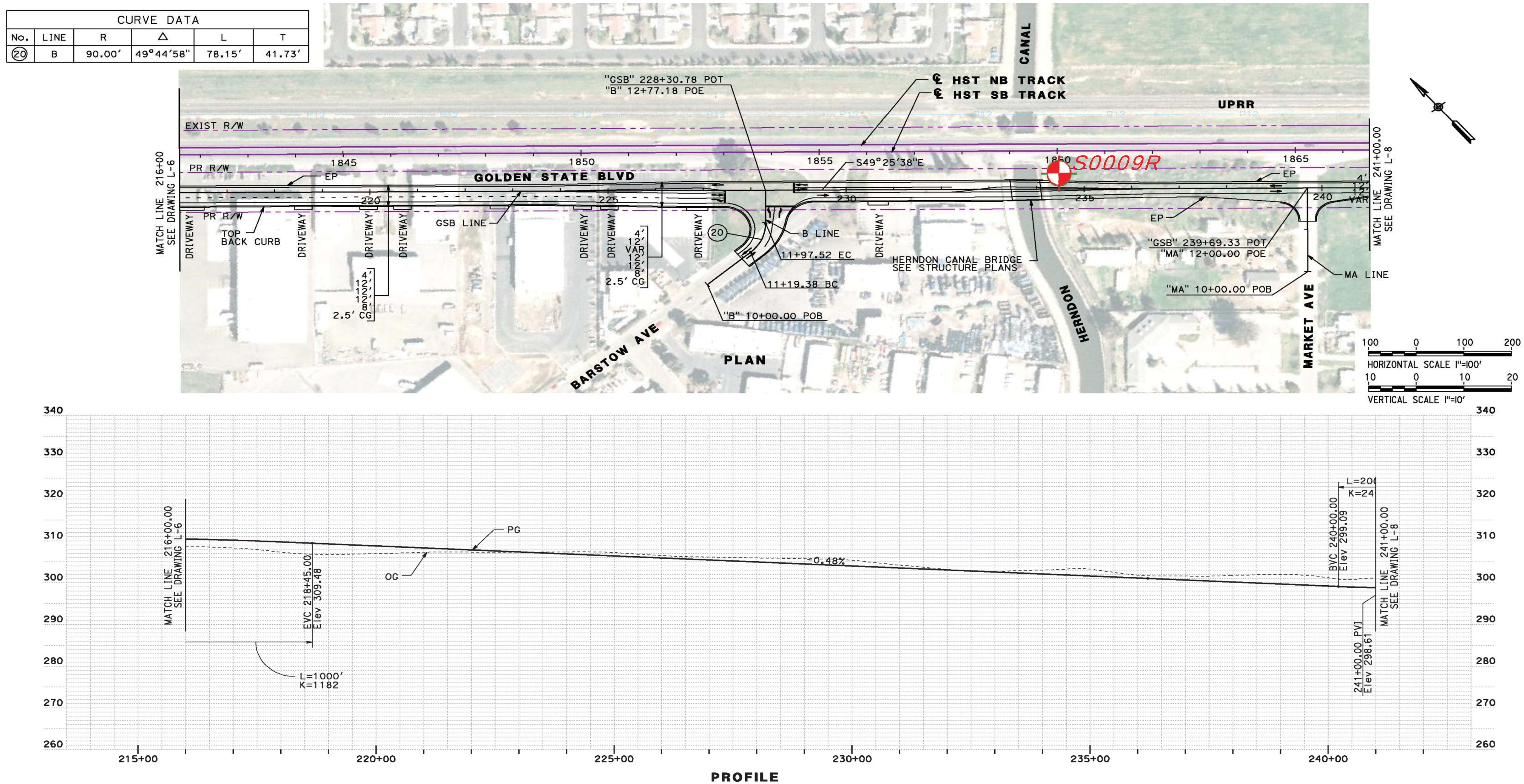
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400 PLATE NO.: 2-6



EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

NOTES: THIS EXPLORATION LOCATION PLAN WAS MODIFIED FROM THE RECORD SET 15% DESIGN SUBMITTAL BY AECOM AND CH2MHILL DATED APRIL 29, 2011.

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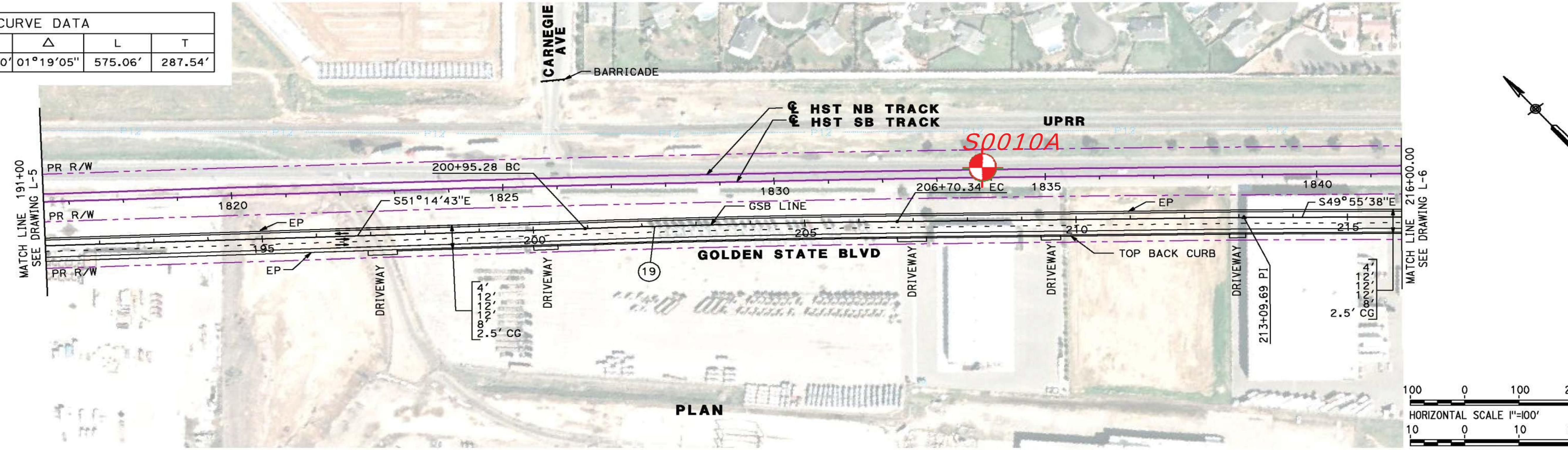
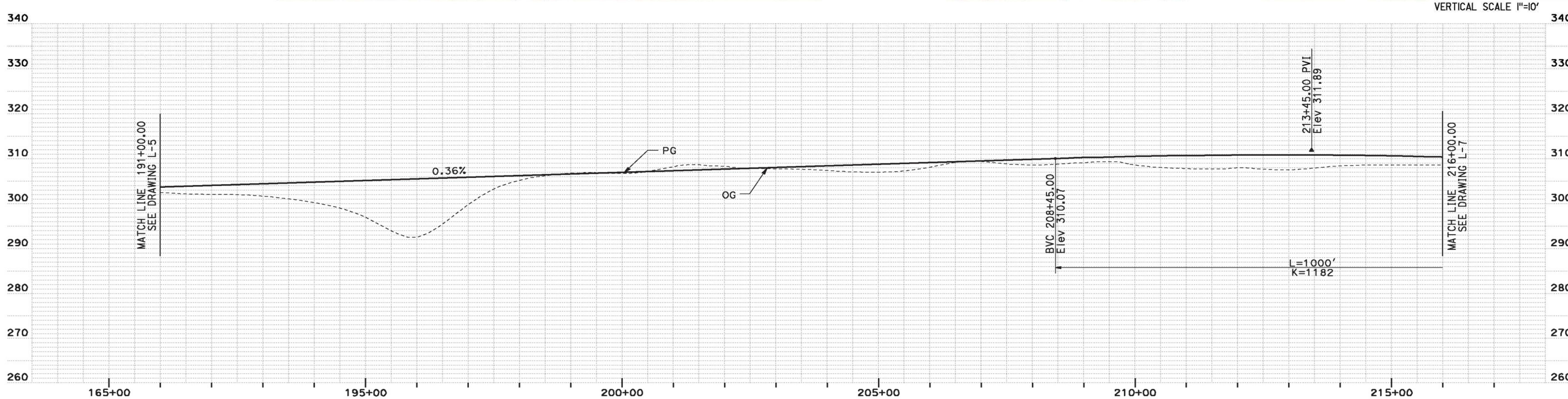
MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400 PLATE NO.: 2-7

CURVE DATA					
No.	LINE	R	△	L	T
19	GSB	25000.00'	01°19'05"	575.06'	287.54'



PLAN



PROFILE

EXPLORATION LOCATION PLAN

LEGEND

Approximate Exploration Location

NOTES: THIS EXPLORATION LOCATION PLAN WAS MODIFIED FROM THE RECORD SET 15% DESIGN SUBMITTAL BY AECOM AND CH2MHILL DATED APRIL 29, 2011.

FLY CALIFORNIA Without ever leaving the ground.

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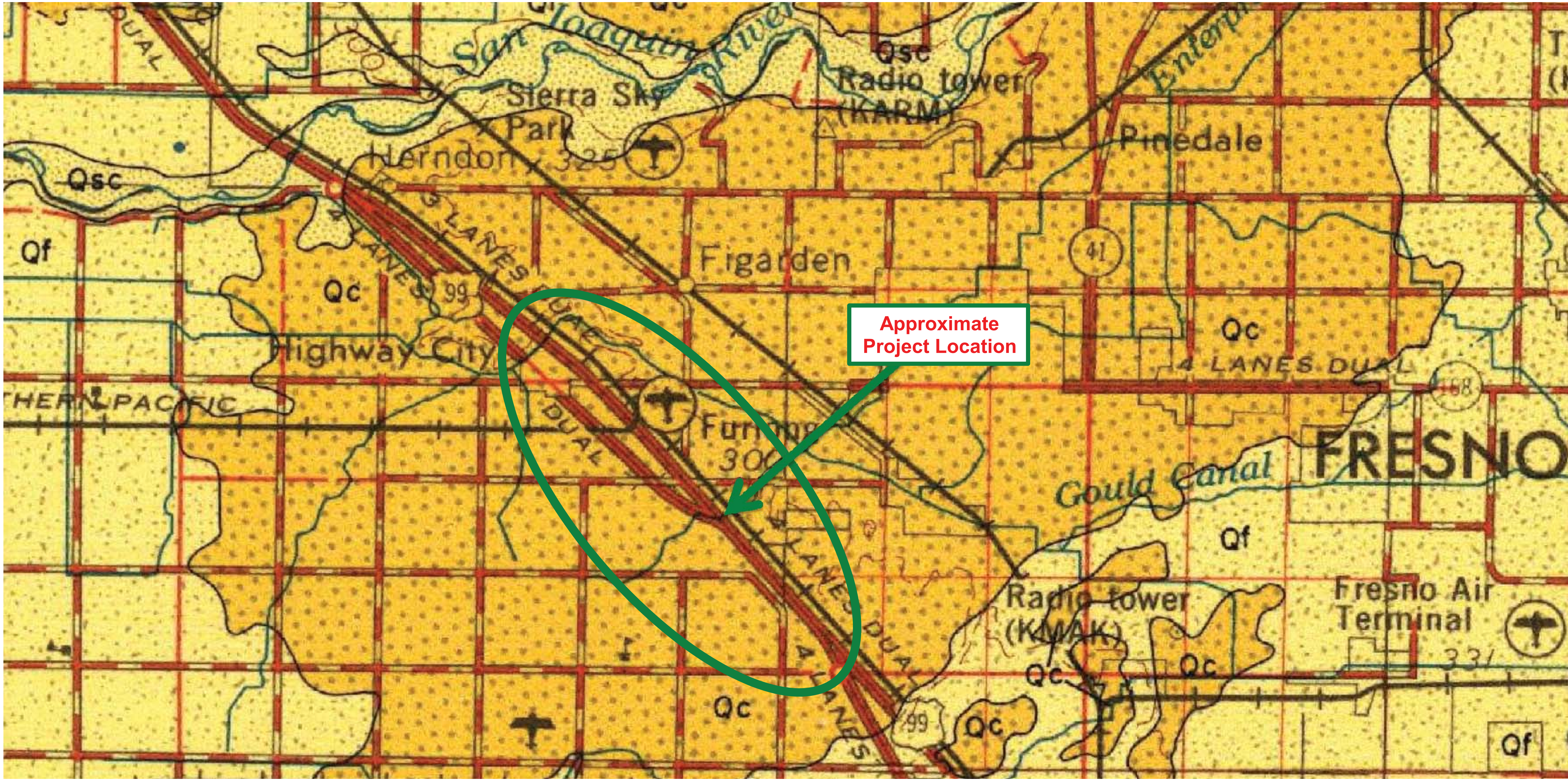
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400 | PLATE NO.: 2-8



Qt	Quaternary nonmarine terrace deposits
Qm	Pleistocene marine and marine terrace deposits
Qc	Pleistocene nonmarine

Source: Matthews, R.A. and Burnett, J.L., 1965, Geologic Map of California: Fresno Sheet: California Division of Mines and Geology, Scale 1:250000.

0 Mile 2.5 5

N

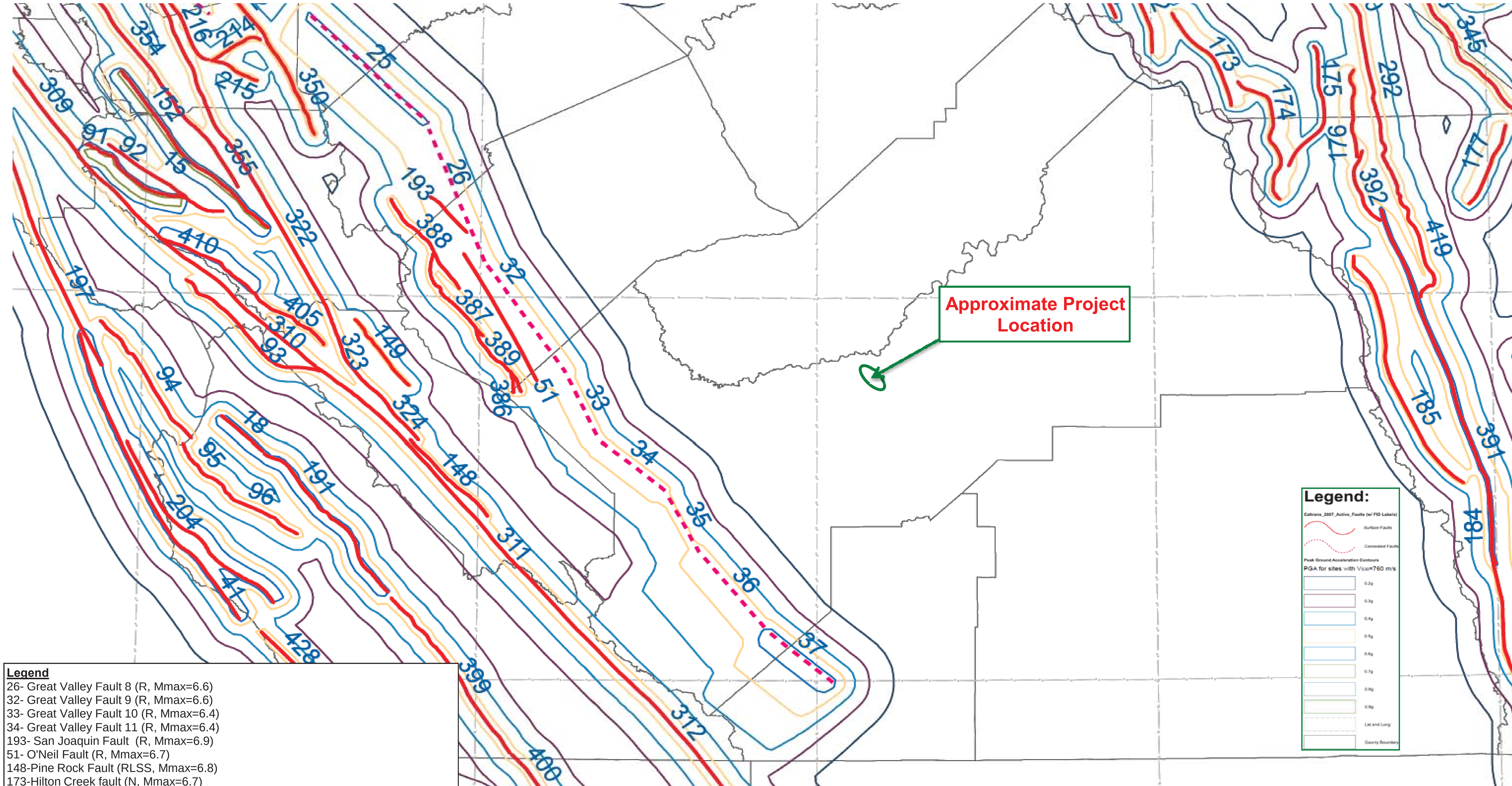
GEOLOGIC MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400

PLATE NO.: 3



Legend

26- Great Valley Fault 8 (R, Mmax=6.6)
32- Great Valley Fault 9 (R, Mmax=6.6)
33- Great Valley Fault 10 (R, Mmax=6.4)
34- Great Valley Fault 11 (R, Mmax=6.4)
193- San Joaquin Fault (R, Mmax=6.9)
51- O'Neil Fault (R, Mmax=6.7)
148-Pine Rock Fault (RLSS, Mmax=6.8)
173-Hilton Creek fault (N, Mmax=6.7)
174-Round Valley fault (N, Mmax=7)
184-Southern Sierra Nevada fault zone (N, Mmax=7.3)
85-Southern Sierra Nevada fault zone (Independence section) (N, Mmax=7.1)
309- San Andreas Fault Zone (Peninsula Section RLSS, Mmax=7.9)
310- San Andreas Fault Zone (Santa Cruz Mountain Section RLSS, Mmax=7.9)
311- San Andreas Fault Zone (Creeping Section RLSS, Mmax=7.9)
312- San Andreas Fault Zone (Parkfield Section RLSS, Mmax=7.9)
386~389-Ortigalita fault zone (RLSS, Mmax=7.1)
Source: *"2007 Caltrans Deterministic PGA Map FID shown September 2007" by Martha Merriam & Tom Shantz*

N

0 Mile 30 60

REGIONAL FAULT MAP

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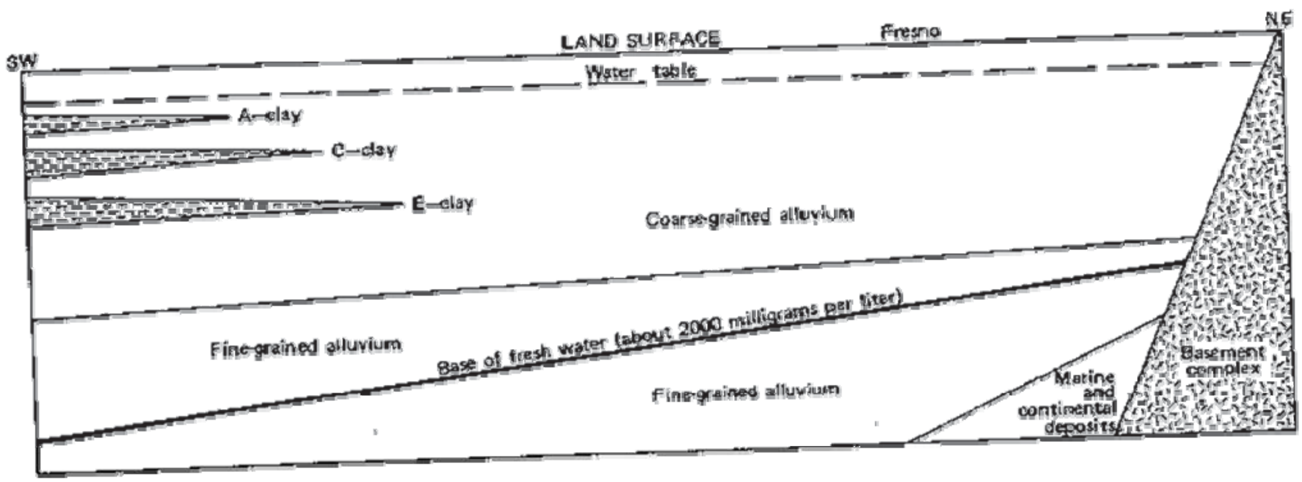
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400

PLATE NO.: 4

Source: Modified from Mitten, H.T. 1984. Groundwater in the Fresno Area, California - Preliminary Report. USGS Water-Resources Investigation Report 83-4246



HYDROGEOLOGIC CROSS-SECTION

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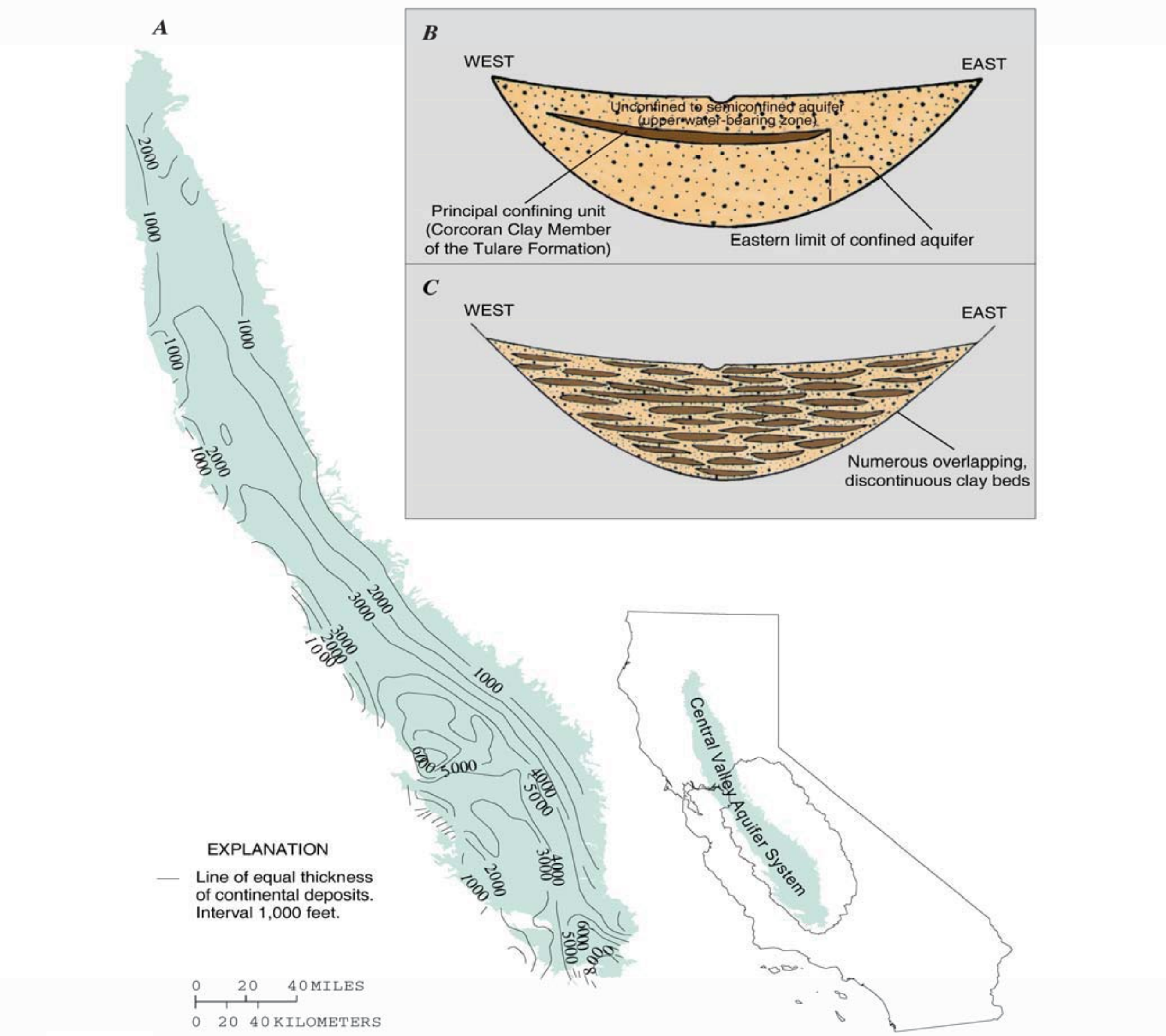
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400

PLATE NO.: 5

Source: USGS Water Resources Investigation Report 97-4205, Environmental Setting of the San Joaquin-Tulare Basins, Californoia



Central Valley, California aquifer system. (*A*) Thickness of continental deposits (adapted from Bertoldi and others, 1991). (*B*) Concept of two-layer aquifer system of the San Joaquin Valley, California (adapted from Poland and Lofgren, 1984). (*C*) Concept of single-layer aquifer system of the San Joaquin Valley, California (adapted from Williamson and others, 1989).

REGIONAL AQUIFER SYSTEM

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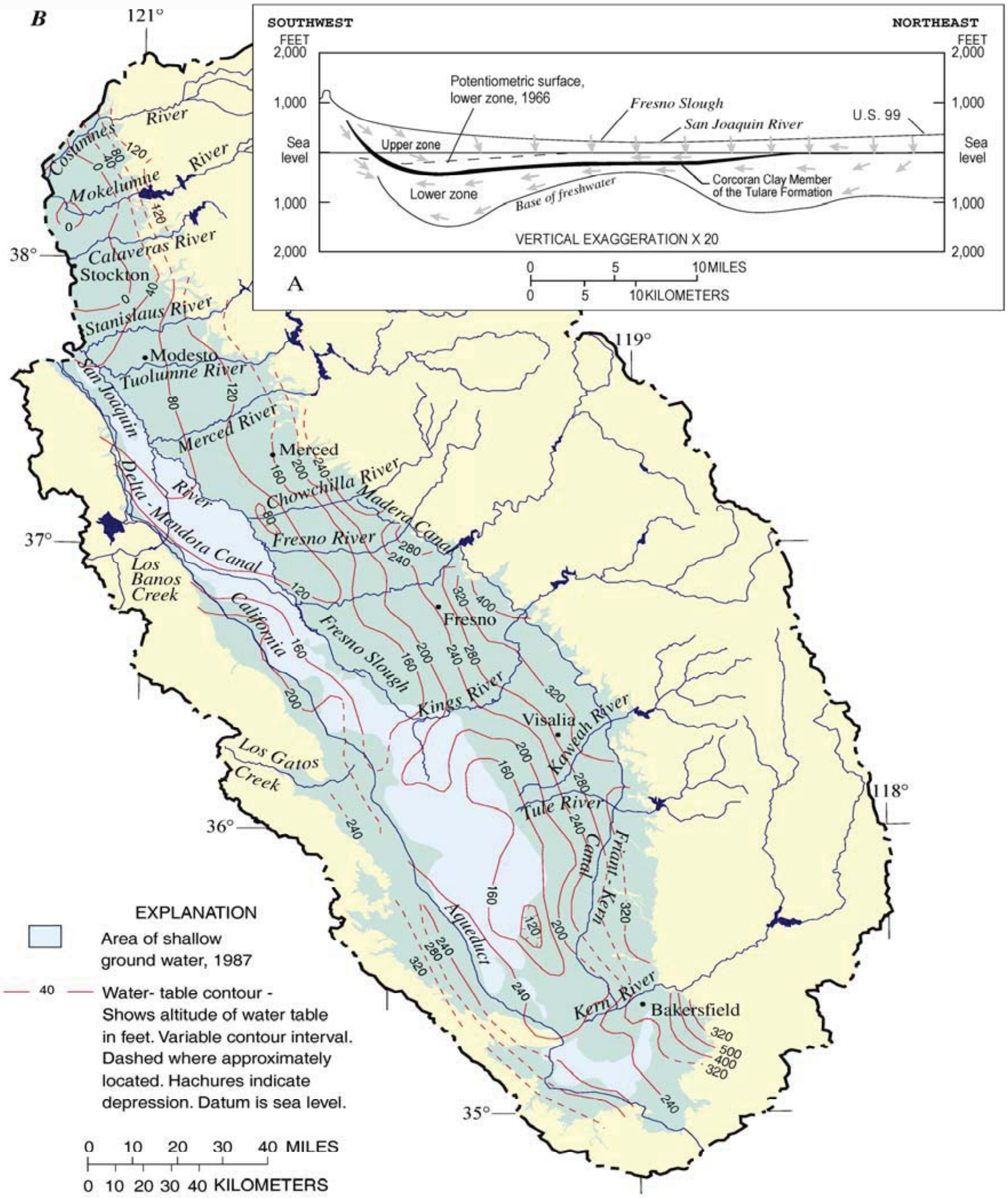
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400

PLATE NO.: 6

Source: USGS Water Resources Investigation Report 97-4205, Environmental Setting of the San Joaquin-Tulare Basins, Californoia



(*A*) Ground-water flow conditions in the San Joaquin Valley, California, 1966 (Bertoldi and others, 1991). (*B*) Water table in 1976 (modified from Williamson and others, 1989) and area of shallow ground water in 1987, San Joaquin Valley, California (San Joaquin Valley Drainage Program, 1990b).

GENERAL GROUNDWATER CONDITIONS

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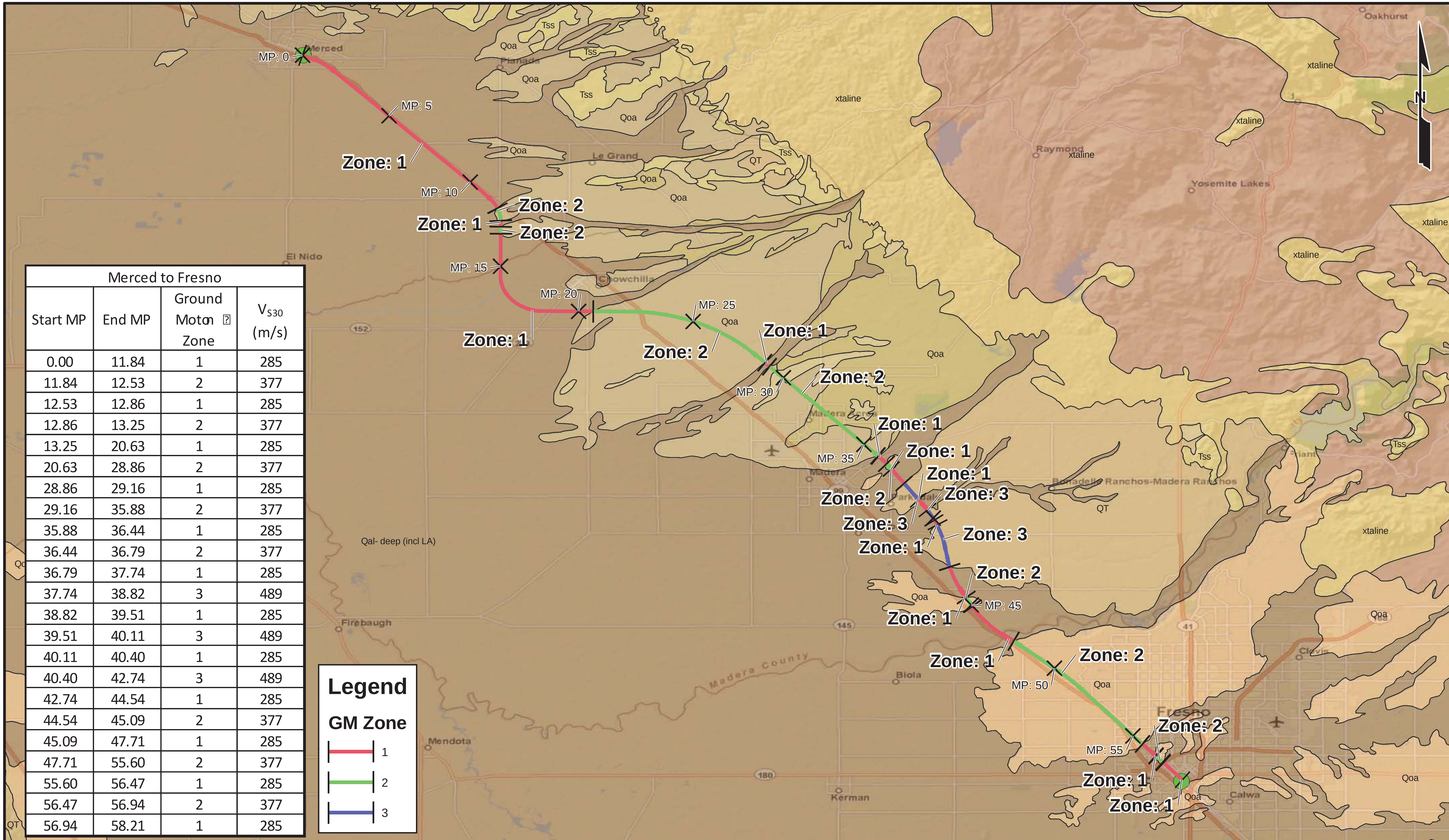
MATERIALS TESTING

MINIMUM ARRA-FUNDED SEGMENT
MERCED TO FRESNO SECTION OF THE
CALIFORNIA HIGH SPEED TRAIN PROJECT

JOB NO.: 2009-138-400	PLATE NO.: 7



Merced to Fresno			
Start MP	End MP	Ground Moton Zone	V_{S30} (m/s)
0.00	11.84	1	285
11.84	12.53	2	377
12.53	12.86	1	285
12.86	13.25	2	377
13.25	20.63	1	285
20.63	28.86	2	377
28.86	29.16	1	285
29.16	35.88	2	377
35.88	36.44	1	285
36.44	36.79	2	377
36.79	37.74	1	285
37.74	38.82	3	489
38.82	39.51	1	285
39.51	40.11	3	489
40.11	40.40	1	285
40.40	42.74	3	489
42.74	44.54	1	285
44.54	45.09	2	377
45.09	47.71	1	285
47.71	55.60	2	377
55.60	56.47	1	285
56.47	56.94	2	377
56.94	58.21	1	285

Legend

GM Zone

- 1
- 2
- 3

0 2.5 5 10 Miles

DRAFT

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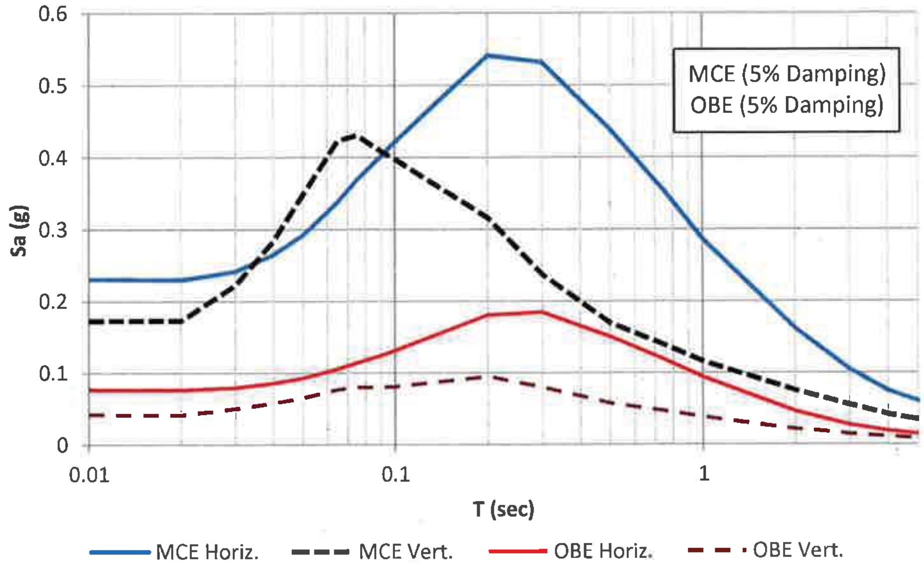
PROJECT NO.	112153
DRAWN:	4/1/11
DRAWN BY:	I.McGovern
CHECKED BY:	Z.Zafir
FILE NAME:	VS30 M-Fre.MXD

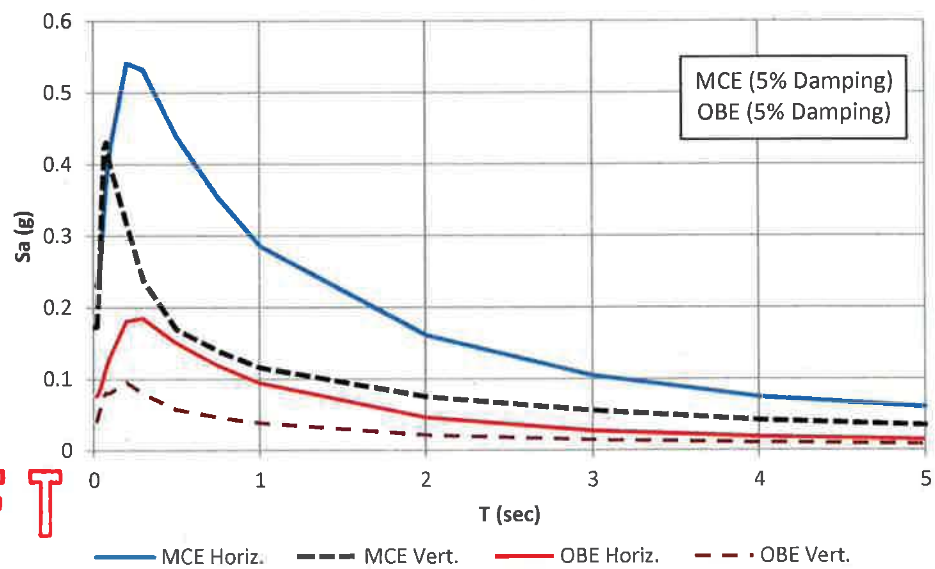
GROUND MOTION ZONE MAP

MERCED TO FRESNO SEGMENT
CALIFORNIA HIGHSPEED TRAIN

PLATE
1

Merced-Fresno Segment, Zone 1 (OBE, 50-Year Return Period)





DRAFT

Period, T (sec)	Spectral Acceleration, Sa (g)				Period, T (sec)	Spectral Acceleration, Sa (g)			
	MCE (5% Damping)		OBE (5% Damping)			MCE (5% Damping)		OBE (5% Damping)	
	Horizontal	Vertical	Horizontal	Vertical		Horizontal	Vertical	Horizontal	Vertical
0.01	0.2309	0.1727	0.0771	0.0419	0.2	0.5413	0.3164	0.1809	0.0951
0.02	0.2300	0.1730	0.0767	0.0417	0.3	0.5319	0.2376	0.1848	0.0800
0.03	0.2417	0.2227	0.0799	0.0504	0.5	0.4389	0.1694	0.1508	0.0580
0.04	0.2654	0.2843	0.0861	0.0581	0.75	0.3531	0.1391	0.1185	0.0469
0.05	0.2925	0.3491	0.0933	0.0659	1	0.2863	0.1161	0.0943	0.0385
0.065	0.3386	0.4231	0.1059	0.0770	2	0.1615	0.0750	0.0462	0.0218
0.075	0.3693	0.4308	0.1145	0.0806	3	0.1050	0.0556	0.0275	0.0148
0.09	0.4024	0.4087	0.1247	0.0803	4	0.0749	0.0422	0.0190	0.0109
0.1	0.4220	0.3977	0.1313	0.0808	5	0.0606	0.0346	0.0147	0.0085

SC SOLUTIONS

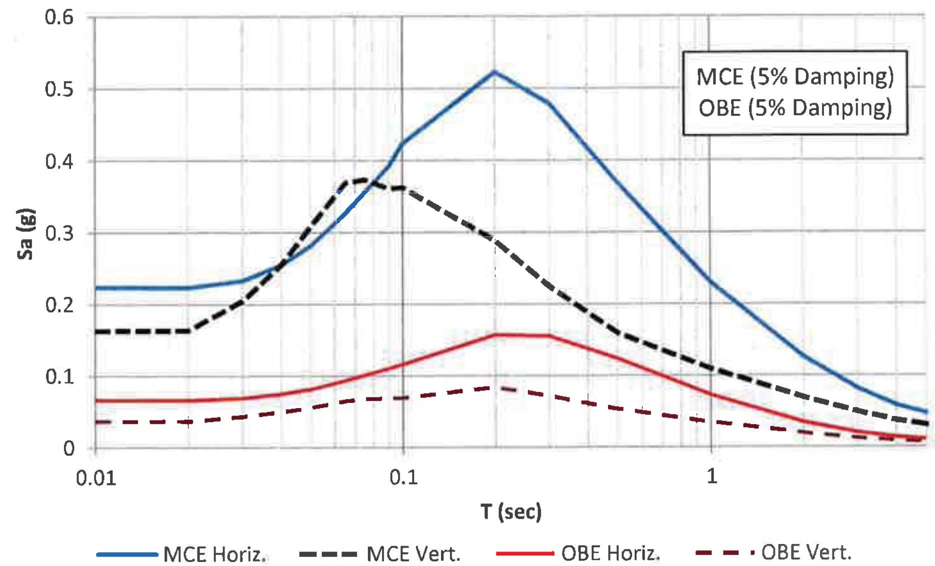
PROJ. NO:
BY: J. Zhong
QC CHECK: M. Perez
QA CHECK: M. Tabatabaie
DATE: 9/02/2011

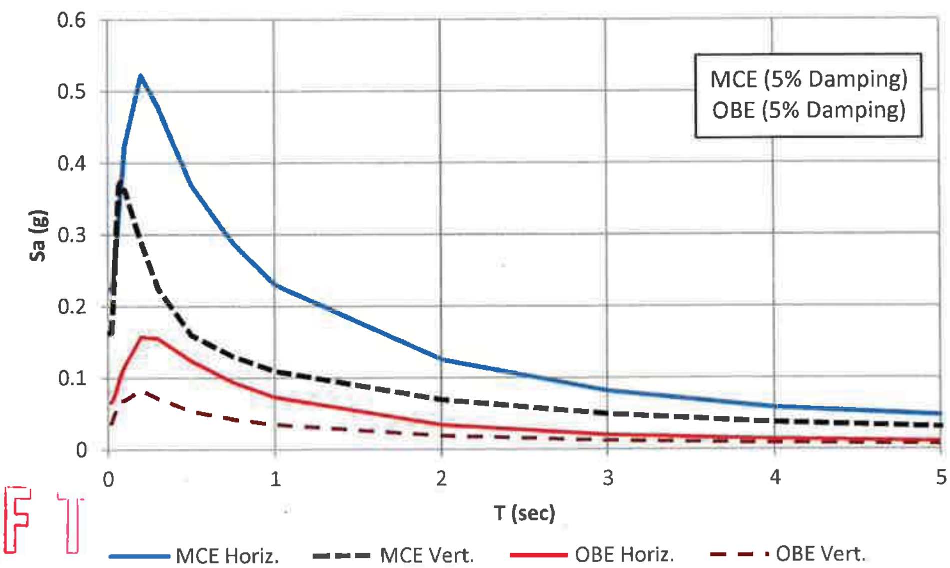
ZONE 1 DESIGN SPECTRA
MERCED-FRESNO SEGMENT

CALIFORNIA HIGH SPEED TRAIN PROJECT
30% DESIGN GROUND MOTIONS

PLATE
1-1

Merced-Fresno Segment, Zone 2 (OBE, 50-Year Return Period)





DRAFT

Period, T (sec)	Spectral Acceleration, Sa (g)				Period, T (sec)	Spectral Acceleration, Sa (g)			
	MCE (5% Damping)		OBE (5% Damping)			MCE (5% Damping)		OBE (5% Damping)	
	Horizontal	Vertical	Horizontal	Vertical		Horizontal	Vertical	Horizontal	Vertical
0.01	0.2241	0.1631	0.0669	0.0367	0.2	0.5230	0.2884	0.1572	0.0836
0.02	0.2234	0.1632	0.0665	0.0366	0.3	0.4792	0.2248	0.1556	0.0719
0.03	0.2333	0.2048	0.0695	0.0436	0.5	0.3694	0.1596	0.1239	0.0537
0.04	0.2548	0.2546	0.0753	0.0496	0.75	0.2874	0.1300	0.0939	0.0429
0.05	0.2817	0.3085	0.0819	0.0558	1	0.2304	0.1094	0.0731	0.0351
0.065	0.3268	0.3688	0.0935	0.0648	2	0.1261	0.0693	0.0348	0.0194
0.075	0.3558	0.3734	0.1014	0.0681	3	0.0818	0.0494	0.0204	0.0125
0.09	0.3929	0.3610	0.1105	0.0686	4	0.0582	0.0374	0.0140	0.0091
0.1	0.4239	0.3628	0.1163	0.0695	5	0.0473	0.0308	0.0108	0.0071

SC SOLUTIONS

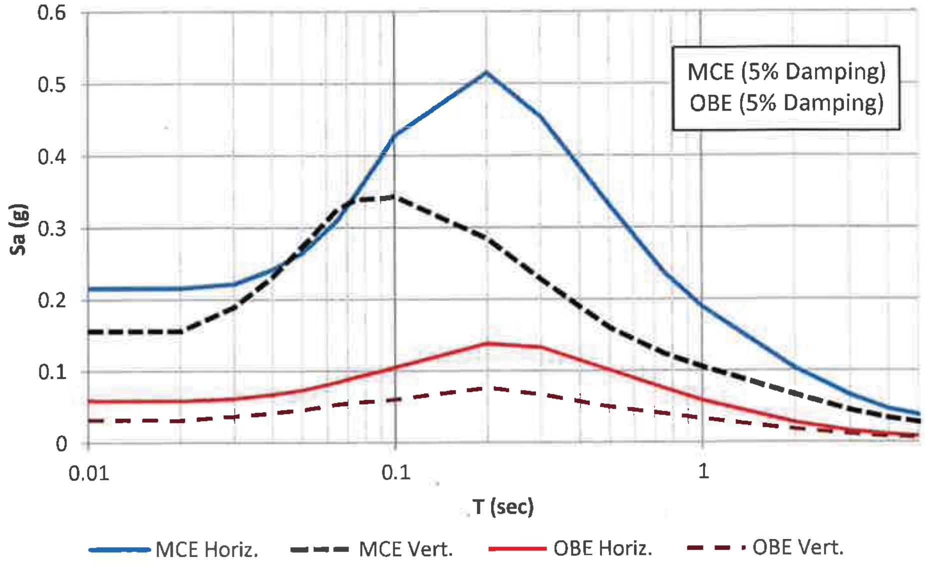
PROJ. NO:
BY: J. Zhong
QC CHECK: M. Perez
QA CHECK: M. Tabatabaie
DATE: 9/02/2011

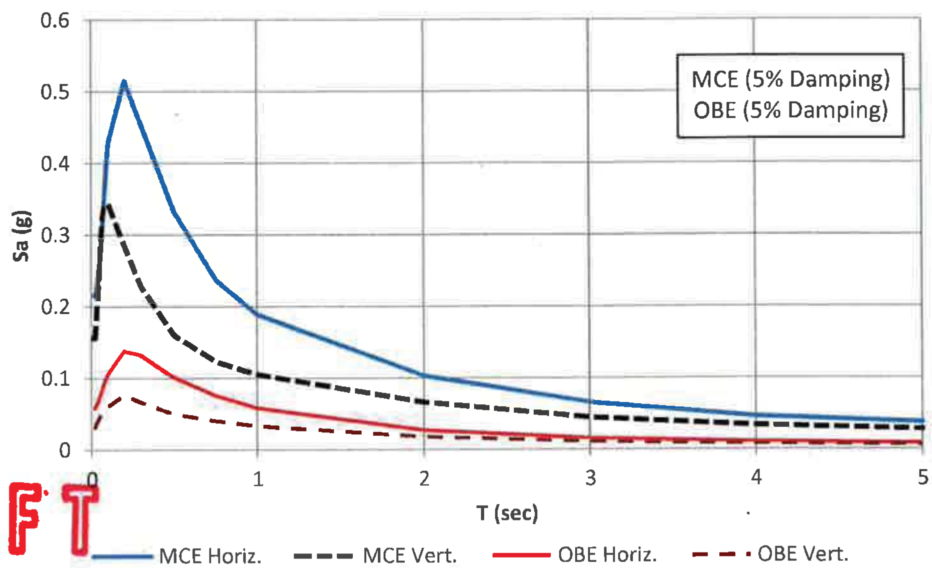
ZONE 2 DESIGN SPECTRA
MERCED-FRESNO SEGMENT

CALIFORNIA HIGH SPEED TRAIN PROJECT
30% DESIGN GROUND MOTIONS

PLATE
1-2

Merced-Fresno Segment, Zone 3 (OBE, 50-Year Return Period)





DRAFT

Period, T (sec)	Spectral Acceleration, Sa (g)				Period, T (sec)	Spectral Acceleration, Sa (g)			
	MCE (5% Damping)		OBE (5% Damping)			MCE (5% Damping)		OBE (5% Damping)	
	Horizontal	Vertical	Horizontal	Vertical		Horizontal	Vertical	Horizontal	Vertical
0.01	0.2160	0.1558	0.0592	0.0319	0.2	0.5150	0.2842	0.1385	0.0764
0.02	0.2155	0.1558	0.0588	0.0317	0.3	0.4541	0.2275	0.1331	0.0667
0.03	0.2219	0.1896	0.0617	0.0373	0.5	0.3316	0.1597	0.1014	0.0499
0.04	0.2419	0.2311	0.0673	0.0418	0.75	0.2375	0.1235	0.0758	0.0404
0.05	0.2650	0.2736	0.0737	0.0464	1	0.1892	0.1051	0.0586	0.0334
0.065	0.3103	0.3259	0.0847	0.0536	2	0.1031	0.0662	0.0275	0.0181
0.075	0.3484	0.3393	0.0921	0.0565	3	0.0659	0.0448	0.0159	0.0111
0.09	0.3973	0.3408	0.1003	0.0586	4	0.0463	0.0335	0.0108	0.0080
0.1	0.4283	0.3436	0.1055	0.0607	5	0.0379	0.0278	0.0084	0.0063

SC SOLUTIONS

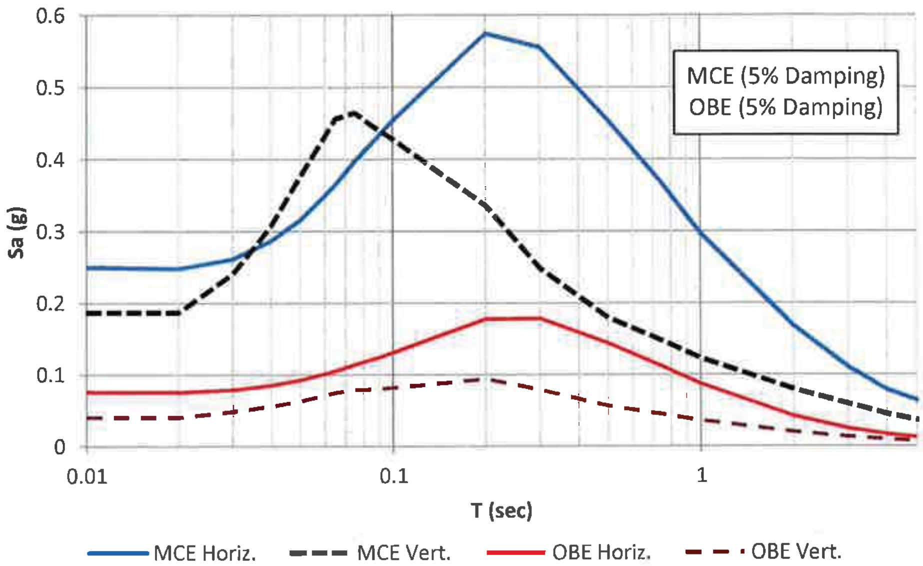
PROJ. NO:
BY: J. Zhong
QC CHECK: M. Perez
QA CHECK: M. Tabatabaie
DATE: 9/02/2011

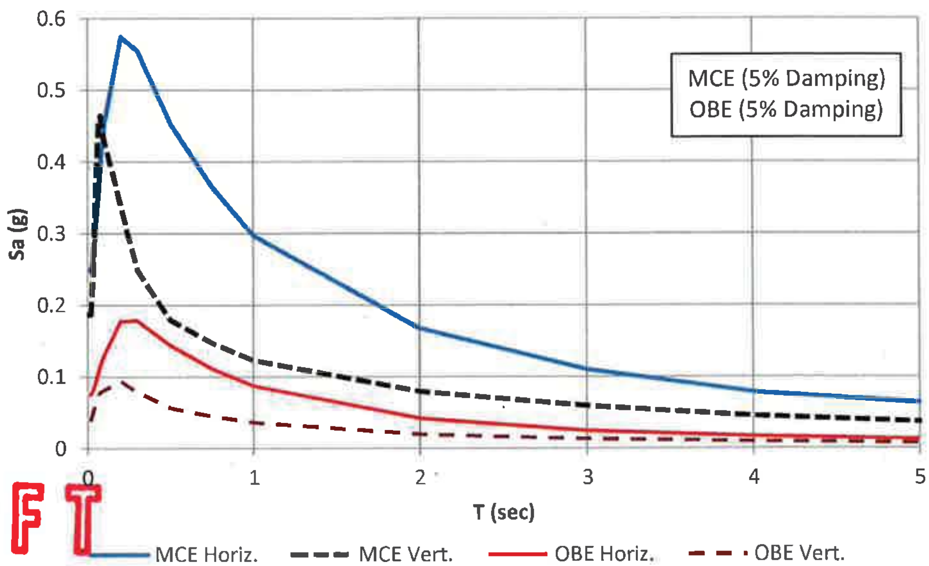
ZONE 3 DESIGN SPECTRA
MERCED-FRESNO SEGMENT

CALIFORNIA HIGH SPEED TRAIN PROJECT
30% DESIGN GROUND MOTIONS

PLATE
1-3

Fresno-Bakersfield Segment, Zone 4 (OBE, 50-Year Return Period)





Period, T (sec)	Spectral Acceleration, Sa (g)				Period, T (sec)	Spectral Acceleration, Sa (g)			
	MCE (5% Damping)		OBE (5% Damping)			MCE (5% Damping)		OBE (5% Damping)	
	Horizontal	Vertical	Horizontal	Vertical		Horizontal	Vertical	Horizontal	Vertical
0.01	0.2498	0.1868	0.0761	0.0407	0.2	0.5745	0.3358	0.1775	0.0941
0.02	0.2482	0.1867	0.0757	0.0405	0.3	0.5556	0.2482	0.1789	0.0792
0.03	0.2613	0.2408	0.0790	0.0489	0.5	0.4538	0.1790	0.1441	0.0569
0.04	0.2870	0.3074	0.0854	0.0563	0.75	0.3654	0.1471	0.1117	0.0450
0.05	0.3160	0.3772	0.0927	0.0638	1	0.2969	0.1230	0.0875	0.0363
0.065	0.3655	0.4567	0.1056	0.0747	2	0.1677	0.0795	0.0421	0.0199
0.075	0.3982	0.4646	0.1143	0.0785	3	0.1101	0.0595	0.0247	0.0134
0.09	0.4334	0.4402	0.1244	0.0801	4	0.0787	0.0452	0.0168	0.0097
0.1	0.4542	0.4280	0.1310	0.0819	5	0.0639	0.0372	0.0130	0.0076

SC SOLUTIONS

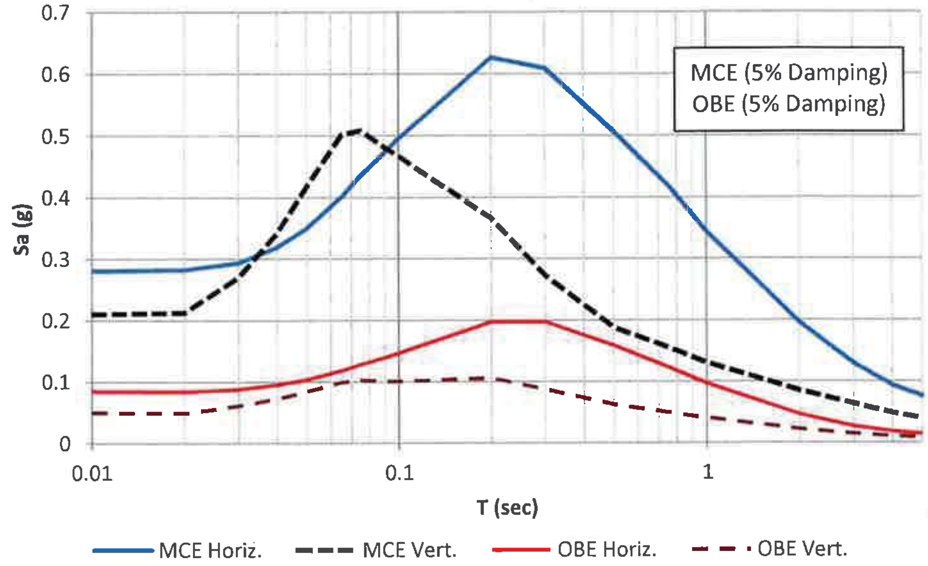
PROJ. NO:
BY: J. Zhong
QC CHECK: M. Perez
QA CHECK: M. Tabatabaie
DATE: 9/02/2011

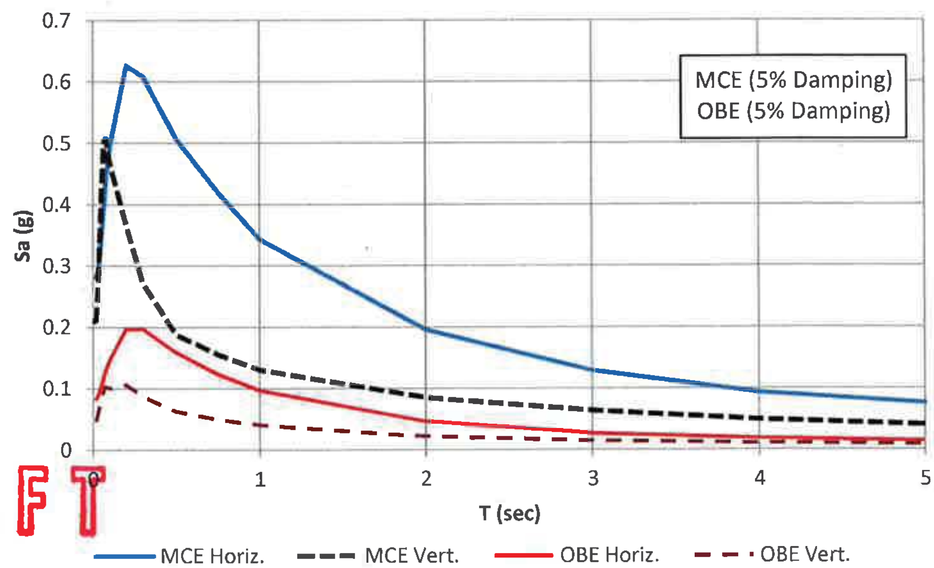
ZONE 4 DESIGN SPECTRA
FRESNO-BAKERFIELD SEGMENT

CALIFORNIA HIGH SPEED TRAIN PROJECT
30% DESIGN GROUND MOTIONS

PLATE
1-4

Fresno-Bakersfield Segment, Zone 5 (OBE, 50-Year Return Period)



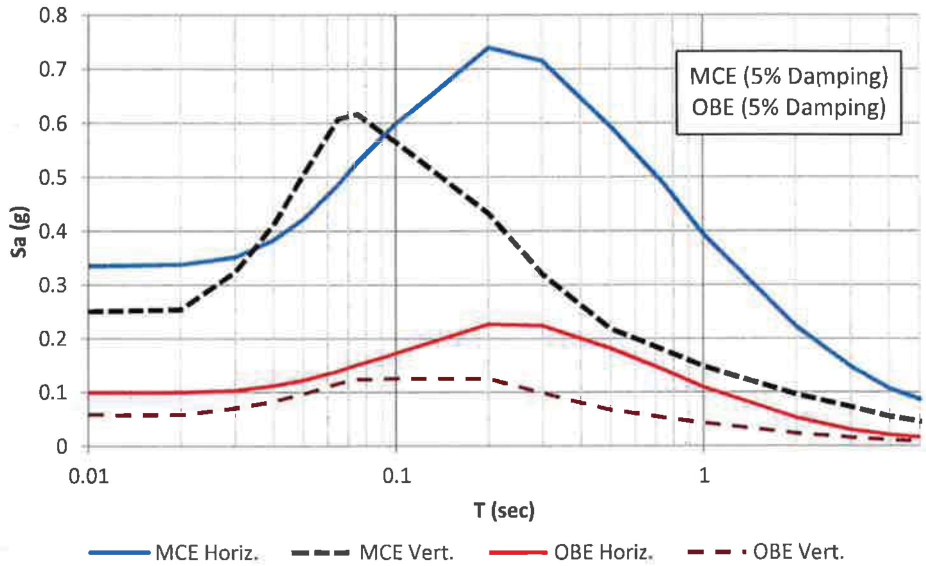


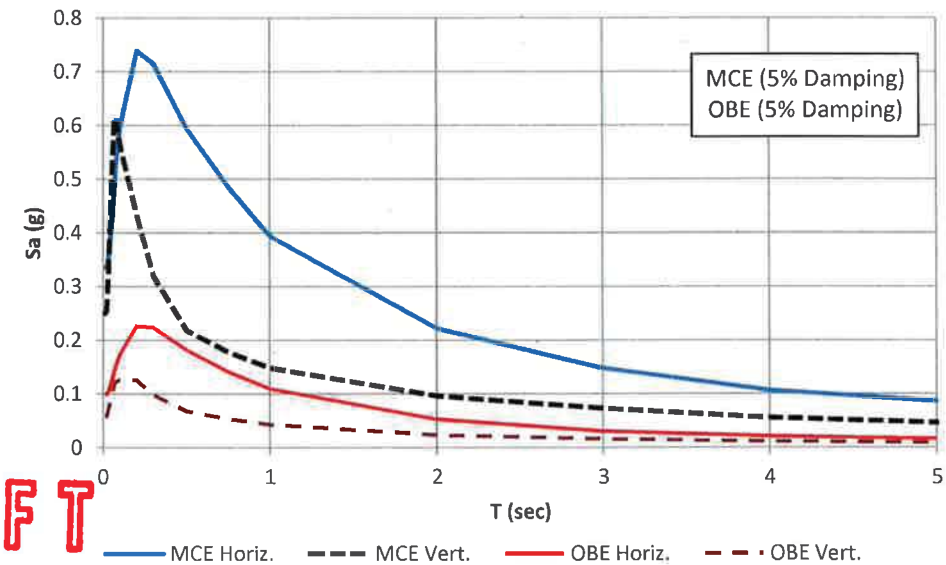
DRAFT

Period, T (sec)	Spectral Acceleration, Sa (g)				Period, T (sec)	Spectral Acceleration, Sa (g)			
	MCE (5% Damping)		OBE (5% Damping)			MCE (5% Damping)		OBE (5% Damping)	
	Horizontal	Vertical	Horizontal	Vertical		Horizontal	Vertical	Horizontal	Vertical
0.01	0.2810	0.2102	0.0848	0.0500	0.2	0.6267	0.3663	0.1972	0.1061
0.02	0.2824	0.2124	0.0841	0.0498	0.3	0.6091	0.2721	0.1976	0.0875
0.03	0.2937	0.2705	0.0881	0.0614	0.5	0.5067	0.1880	0.1590	0.0633
0.04	0.3195	0.3422	0.0955	0.0727	0.75	0.4190	0.1554	0.1236	0.0504
0.05	0.3505	0.4183	0.1039	0.0843	1	0.3431	0.1305	0.0973	0.0409
0.065	0.4017	0.5019	0.1186	0.0994	2	0.1959	0.0850	0.0463	0.0223
0.075	0.4360	0.5087	0.1286	0.1032	3	0.1290	0.0639	0.0273	0.0150
0.09	0.4731	0.4805	0.1399	0.1012	4	0.0929	0.0489	0.0186	0.0109
0.1	0.4953	0.4667	0.1472	0.1008	5	0.0762	0.0407	0.0145	0.0086

SC SOLUTIONS	PROJ. NO: BY: J. Zhong QC CHECK: M. Perez QA CHECK: M. Tabatabaie DATE: 9/02/2011	ZONE 5 DESIGN SPECTRA FRESNO-BAKERFIELD SEGMENT CALIFORNIA HIGH SPEED TRAIN PROJECT 30% DESIGN GROUND MOTIONS	PLATE 1-5

Fresno-Bakersfield Segment, Zone 6 (OBE, 50-Year Return Period)





DRAFT

Period, T (sec)	Spectral Acceleration, Sa (g)				Period, T (sec)	Spectral Acceleration, Sa (g)			
	MCE (5% Damping)		OBE (5% Damping)			MCE (5% Damping)		OBE (5% Damping)	
	Horizontal	Vertical	Horizontal	Vertical		Horizontal	Vertical	Horizontal	Vertical
0.01	0.3354	0.2508	0.0999	0.0587	0.2	0.7398	0.4324	0.2272	0.1259
0.02	0.3379	0.2541	0.1001	0.0590	0.3	0.7158	0.3198	0.2247	0.0987
0.03	0.3515	0.3238	0.1040	0.0717	0.5	0.5940	0.2185	0.1824	0.0678
0.04	0.3837	0.4111	0.1126	0.0838	0.75	0.4852	0.1775	0.1414	0.0536
0.05	0.4227	0.5045	0.1227	0.0974	1	0.3942	0.1485	0.1101	0.0431
0.065	0.4863	0.6076	0.1399	0.1168	2	0.2226	0.0960	0.0530	0.0239
0.075	0.5286	0.6167	0.1516	0.1240	3	0.1479	0.0728	0.0311	0.0160
0.09	0.5733	0.5823	0.1647	0.1250	4	0.1064	0.0557	0.0214	0.0117
0.1	0.5991	0.5646	0.1730	0.1257	5	0.0870	0.0462	0.0166	0.0092

SC SOLUTIONS

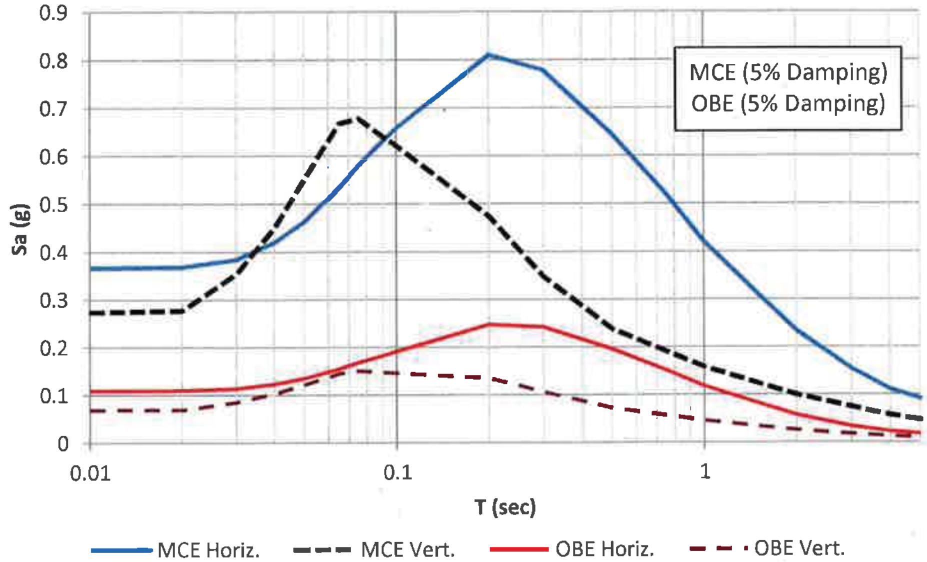
PROJ. NO:
BY: J. Zhong
QC CHECK: M. Perez
QA CHECK: M. Tabatabaie
DATE: 9/02/2011

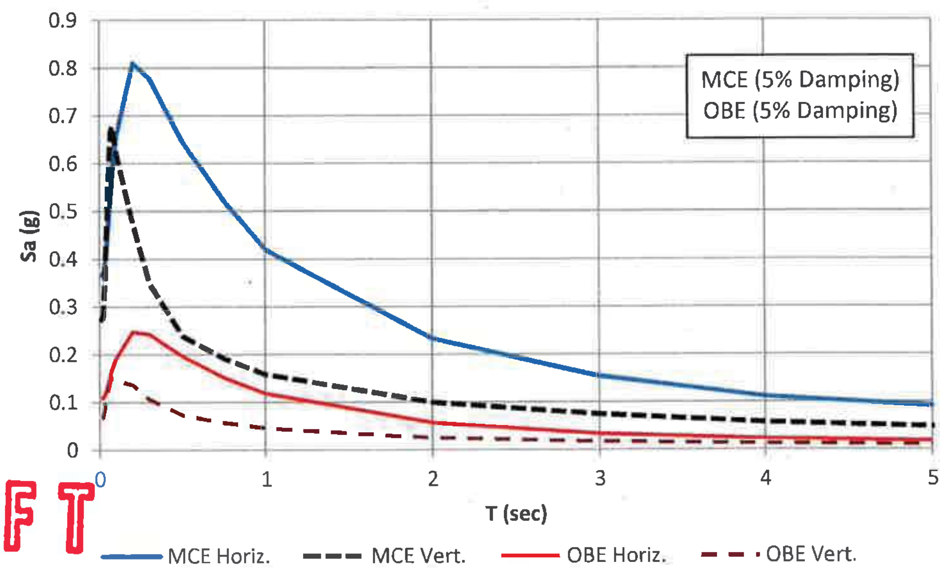
ZONE 6 DESIGN SPECTRA
FRESNO-BAKERFIELD SEGMENT

CALIFORNIA HIGH SPEED TRAIN PROJECT
30% DESIGN GROUND MOTIONS

PLATE
1-6

Fresno-Bakersfield Segment, Zone 7 (OBE, 50-Year Return Period)





DRAFT

Period, T (sec)	Spectral Acceleration, Sa (g)				Period, T (sec)	Spectral Acceleration, Sa (g)			
	MCE (5% Damping)		OBE (5% Damping)			MCE (5% Damping)		OBE (5% Damping)	
	Horizontal	Vertical	Horizontal	Vertical		Horizontal	Vertical	Horizontal	Vertical
0.01	0.3662	0.2738	0.1094	0.0688	0.2	0.8105	0.4737	0.2478	0.1361
0.02	0.3685	0.2771	0.1097	0.0693	0.3	0.7786	0.3478	0.2426	0.1062
0.03	0.3840	0.3538	0.1141	0.0856	0.5	0.6451	0.2382	0.1967	0.0727
0.04	0.4201	0.4500	0.1238	0.1029	0.75	0.5202	0.1914	0.1519	0.0572
0.05	0.4633	0.5530	0.1355	0.1218	1	0.4198	0.1582	0.1184	0.0461
0.065	0.5341	0.6673	0.1549	0.1454	2	0.2334	0.0994	0.0571	0.0256
0.075	0.5810	0.6779	0.1681	0.1511	3	0.1543	0.0748	0.0338	0.0173
0.09	0.6304	0.6403	0.1826	0.1478	4	0.1110	0.0572	0.0233	0.0127
0.1	0.6586	0.6207	0.1916	0.1464	5	0.0912	0.0477	0.0182	0.0100

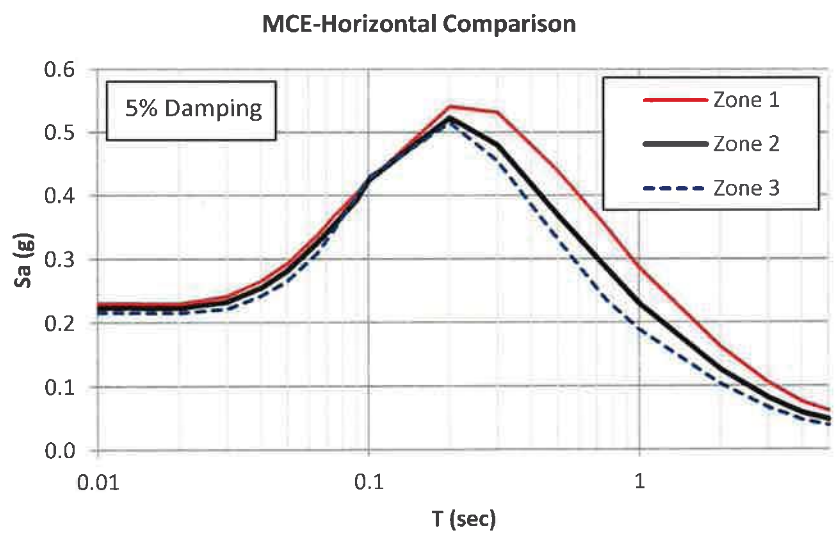
SC SOLUTIONS

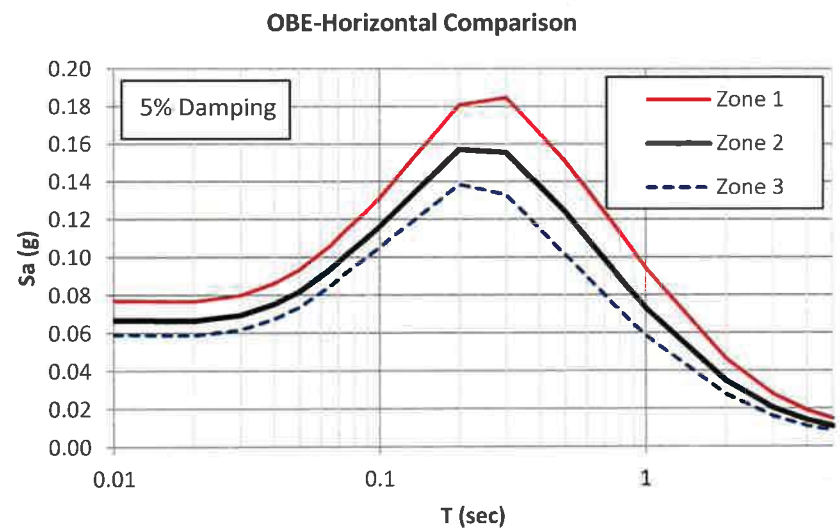
PROJ. NO:
BY: J. Zhong
QC CHECK: M. Perez
QA CHECK: M. Tabatabaie
DATE: 9/02/2011

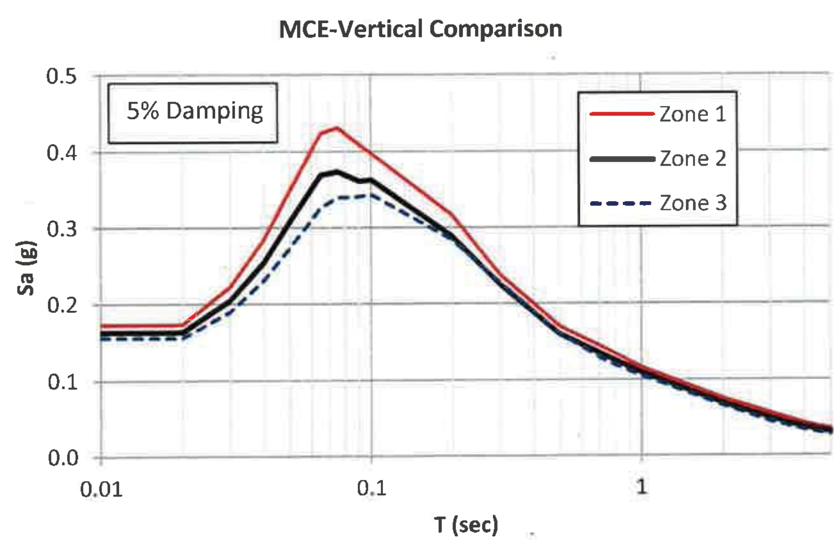
ZONE 7 DESIGN SPECTRA
FRESNO-BAKERFIELD SEGMENT

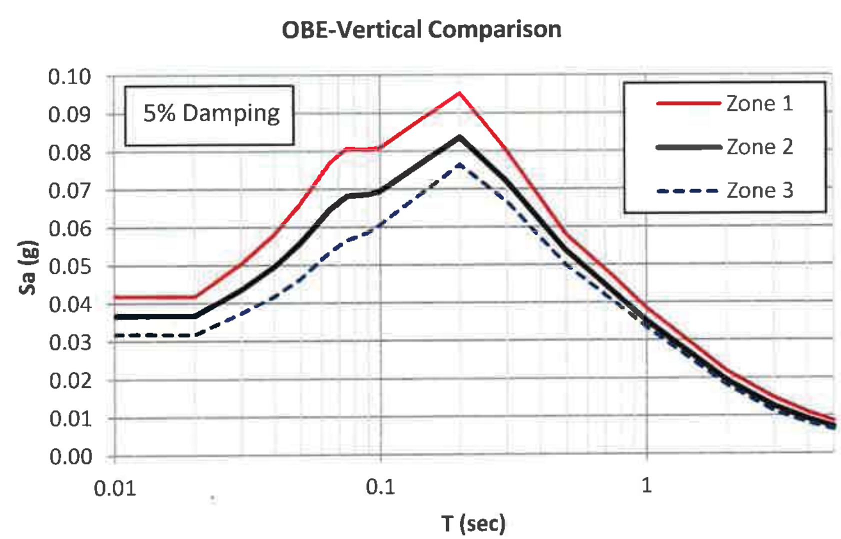
CALIFORNIA HIGH SPEED TRAIN PROJECT
30% DESIGN GROUND MOTIONS

PLATE
1-7



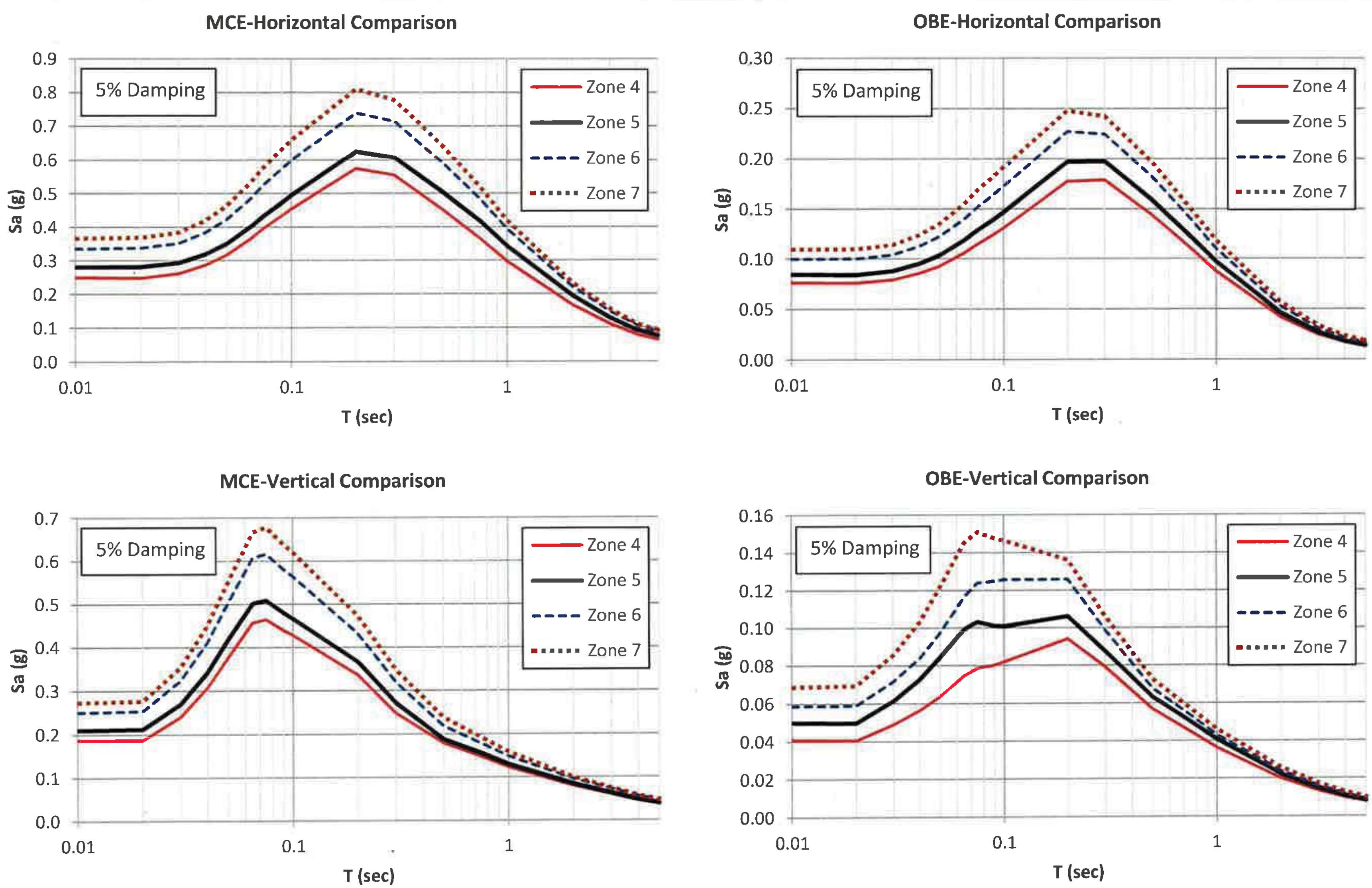






SC SOLUTIONS	PROJ. NO: BY: J. Zhong QC CHECK: M. Perez QA CHECK: M. Tabatabaie DATE: 9/02/2011	**ZONES 1-3 DESIGN SPECTRA MERCED-FRESNO SEGMENT** CALIFORNIA HIGH SPEED TRAIN PROJECT 30% DESIGN GROUND MOTIONS	PLATE **1-8**

DRAFT



SC SOLUTIONS	PROJ. NO: BY: J. Zhong QC CHECK: M. Perez QA CHECK: M. Tabatabaie DATE: 9/02/2011	**ZONES 4-7 DESIGN SPECTRA** **FRESNO-BAKERSFIELD SEGMENT** CALIFORNIA HIGH SPEED TRAIN PROJECT 30% DESIGN GROUND MOTIONS	PLATE **1-9**

DRAFT

APPENDIX A

- Log of Test Borings (PARIKH 2011)
- Subsurface Stratigraphic Cross-Section
- Cone Penetration Test (CPT) Report
- Log of Test Borings – Caltrans As-Built Logs

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic / Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
DS	Direct Shear (ASTM D 3080-04)
EI	Expansion Index (ASTM D 4829-03)
M	Moisture Content (ASTM D 2216-05)
OC	Organic Content (ASTM D 2974-07)
P	Permeability (CTM 220 - 05)
PA	Particle Size Analysis (ASTM D 422-63 [2002])
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
PL	Point Load Index (ASTM D 5731-05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R-Value (CTM 301 - 00)
SE	Sand Equivalent (CTM 217 - 99)
SG	Specific Gravity (AASHTO T 100-06)
SL	Shrinkage Limit (ASTM D 427-04)
SW	Swell Potential (ASTM D 4546-03)
TV	Pocket Torvane
UC	Unconfined Compression - Soil (ASTM D 2166-06) Unconfined Compression - Rock (ASTM D 2938-95)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

Standard Penetration Test (SPT)

Standard California Sampler

Modified California Sampler

Shelby Tube

Piston Sampler

NX Rock Core

HQ Rock Core

Bulk Sample

Other (see remarks)

DRILLING METHOD SYMBOLS

Auger Drilling

Rotary Drilling

Dynamic Cone or Hand Driven

Diamond Core

WATER LEVEL SYMBOLS

First Water Level Reading (during drilling)

Static Water Level Reading (short-term)

Static Water Level Reading (long-term)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011	Job No.: 2009-138-400

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-1A

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Descriptor	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

NOTE: This legend sheet provides descriptors and associated criteria for required soil description components only.

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-1B

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
L.S. Bhangoo	**10-26-11**	**10-26-11**	**36° 46' 17" / -119° 50' 14"**	**S0001A**

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Technicon Engineering Services, Inc.	**STA 2072+50**	
DRILLING METHOD	DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger	**CME 55**	**8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)	SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
MC (2.5" I.D.) - SPT (1.4" I.D.)	**140 lbs**	**87%**
BOREHOLE BACKFILL AND COMPLETION	GROUNDWATER READINGS — DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
NEAT CEMENT	**115.0 ft on 10-26-11**	**121.5 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Remarks
	0	CLAYEY SAND (SC); very dense; light grayish brown; moist; mostly fine SAND; moderate cementation.										
	2	Trace fine GRAVEL; (+#4=2.1%, -#200=28.5%).										
	3						2					PA
	4	SILTY SAND (SM); very dense; light grayish brown; moist; mostly fine SAND; (+#4=2.1%, -#200=32.7%).										PA, R, CP (Bulk 2'-5') PA
	5	SILTY SAND with GRAVEL (SM); loose; light grayish brown; moist; some fine GRAVEL; mostly fine SAND.		S02	5 4 3	7	1			56		
	6											CR
	10	SILTY SAND (SM); medium dense; light yellowish brown; moist; mostly fine SAND; (-#200=17.4%).		S03	3 6 7	13				67		
	11						1					PA
	15	Light grayish brown.		S04	3 5 7	12	0			72		
	20	Poorly graded SAND (SP); medium dense; light grayish brown; moist; mostly fine SAND; (+#4=0%, -#200=2.9%).		S05	3 7 8	15				89		
	21						1					PA
	25											

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25		SANDY SILT (ML); stiff; light yellowish brown; moist; mostly fine SAND.		S06	13 27 28	55	3			83				
	28		SILTY SAND (SM); dense; light grayish brown; moist; mostly fine SAND.												
	30		Dense.		S07	14 18 18	36	1			72				
	35				S08	5 8 13	21	1			78				
	38		CLAYEY SAND (SC); dense; light brown; moist; mostly fine SAND.												
	40		Very dense.		S09	25 33 50/2"	83/8	6			72				PA
	41		SANDY SILT (ML); hard; light yellowish brown; moist; mostly fine SAND; (-#200=51.4%).												
	45				S10	39 60/5"	60/5				61				
	48		SILTY SAND (SM); dense; olive gray; moist; mostly medium to fine SAND.												
	50				S11	8 22 29	51	1			72				
	52.5		Lean CLAY with SAND (CL); hard; light grayish brown; moist; mostly fine SAND; low to medium plasticity fines.												
	55														

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-2B

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	55–58.5		SILT (ML); hard; light grayish brown; moist; some fines. *layer description continued from previous page*		S12	6 25 63	88				72				PI, UU PI
	58.5–65		CLAYEY SAND (SC); very dense; reddish black; moist; mostly fine SAND. (+#4=0%, -#200=39.8%).		S13	19 60/5"	60/5	9			72				PA
	65–72		SILTY SAND (SM); very dense; brown; moist; mostly fine SAND.		S14	23 60/3"	60/3	11	115		50				DS
					S15	25 60/2"	60/2				44				CL
	72–74		SANDY lean CLAY (CL); hard; yellowish brown; moist; mostly fine SAND; low to medium plasticity fines.												
	74–79		SILT (ML); hard; brown; moist; some SILT.		S16	5 12 15	27	14	93	PP = >4	67				
	79–85		SILT with SAND (ML); hard; light grayish brown; moist; little fine SAND; mostly fines.		S17	9 22 33	55	20	97	PP = >4	83				

Depth scale: 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-2C

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
			SILT with SAND (ML) *(continued)*.		S18	18 27 32	59	7	103		83				
	86		SILTY SAND (SM); very dense; hard; brown; moist; mostly fine SAND; (-#200=34.8%).												PA
	90				S19	25 44 60/3"	104/9	14	105		78				
	94		Yellowish brown; moist; some medium to fine SAND.												
	95				S20	31 60/6"	60/6	14	91		56				
	100		(+#4=0%, -#200=26.4%).		S21	24 53 60/4"	113/10	14	97		78				PA
	103		SILT (ML); hard; light grayish brown; moist.												
	105				S22	14 54 60/5"	114/11	25	96	PP = >4	72				
	108.5		SILTY SAND (SM); very dense; light brown; moist; mostly fine SAND.												
	110		Dense; light olive brown.		S23	7 20 29	49	26	93		83				DS
	115														

(continued)

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MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-2D

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	116–120		Very dense; yellowish brown; wet; mostly medium to fine SAND. SILTY SAND (SM) *(continued)*. SILTY SAND (SM); very dense; light brown; moist; mostly fine SAND. *layer description continued from previous page*		S24	12 27 31	58	31	90		89				
	120–121.5		Lean CLAY (CL); hard; light brown; wet; low to medium plasticity fines.		S25	3 19 27	46				78				

Boring terminated at planned depth.
Bottom of borehole at 121.5 ft bgs.

Depth scale: 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
L.S. Bhangoo	**10-31-11**	**10-31-11**	**36° 46' 48" / -119° 50' 46"**	**S0002A**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Technicon Engineering Services, Inc.			**STA 2034+00**	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 55**	**8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
MC (2.5" I.D.) - SPT (1.4" I.D.)			**140 lbs**	**87%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS — DURING DRILLING — AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
NEAT CEMENT			**Not encountered on 10-31-2011**	**31.5 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Remarks
	0	SILTY SAND (SM); dense; reddish brown; moist; mostly fine SAND; moderate to strong cementation.									
	2	(+#4=0%, -#200=34.5%).	S01	7 9 13	22	5	114		72		PA
	4	Trace fine GRAVEL; (+#4=3.2%, -#200=34.3%).									PA, CP, EI (Bulk 2'-5') PA
	5	Very dense.	S02	10 19 35	54	8			83		CR
	10		S03	3 9 16	25	11	116		100		
	11	Medium dense; light reddish brown.									DS
	15		S04	3 7 9	16	10			89		PA
	16	Poorly graded SAND with SILT (SP-SM); medium dense; light grayish brown; moist; mostly fine SAND; (+#4=0%, -#200=6.8%).									
	20		S05	3 4 8	12	6			89		
	21	Mostly coarse to medium SAND.									
	25										

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-3A

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25		Poorly graded SAND with SILT (SP-SM) *(continued)*.		S06	3 5 7	12	4			100				PA
	26		Poorly graded SAND (SP); medium dense; light grayish brown; moist; mostly fine SAND; (+#4=0%, -#200=2.9%).												
	30				S07	5 12 18	30	3			78				
	32		Boring terminated at planned depth. Bottom of borehole at 31.5 ft bgs.												

Depth scale: 25–55 ft.

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

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Plate: A-3B

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
L.S. Bhangoo	**10-31-11**	**10-31-11**	**36° 47' 9" / -119° 51' 9"**	**S0003A**
DRILLING CONTRACTOR **Technicon Engineering Services, Inc.**			BOREHOLE LOCATION (Offset, Station, Line) **STA 2004+00**	SURFACE ELEVATION
DRILLING METHOD **Hollow-Stem Auger**			DRILL RIG **CME 55**	BOREHOLE DIAMETER **8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID) **MC (2.5" I.D.) - SPT (1.4" I.D.)**			SPT HAMMER TYPE **140 lbs**	HAMMER EFFICIENCY, ERi **87%**
BOREHOLE BACKFILL AND COMPLETION **NEAT CEMENT**			GROUNDWATER READINGS — DURING DRILLING / AFTER DRILLING (DATE) **Not encountered on 10-31-2011**	TOTAL DEPTH OF BORING **31.5 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Remarks
	0	SILTY SAND (SM); very dense; reddish brown; moist; mostly fine SAND; moderate to strong cementation.									
	2	(+#4=0%, -#200=31.1%).	S01	8 25 50/2"	75/8	10	110		67		PA
	4	Trace fine GRAVEL; (+#4=2.3%, -#200=33.3%).									PA, CP (Bulk 2'-5') PA
	5		S02	12 25 12	37	15			72		
	6	Very dense; brown; some fine SAND.									CR
	10		S03	5 9 13	22	14	99		100		
	11	Medium dense; dark grayish brown; mostly fine SAND.									DS
	15		S04	2 3 4	7	3			100		PA
	16	Poorly graded SAND (SP); loose; light grayish brown; moist; mostly fine SAND; (+#4=0%, -#200=2.4%).									
	20		S05	2 4 7	11	3			100		
	21	Medium dense; mostly coarse to medium SAND.									
	25										

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-5A

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25		Poorly graded SAND (SP); loose; light grayish brown; moist; mostly fine SAND; (+#4=0%, -#200=2.4%).		S06	6 11 11	22	6			89				PA
	26		*layer description continued from previous page* Poorly graded SAND (SP) *(continued)*.												
	27		Poorly graded SAND with SILT (SP-SM); dense; light grayish brown; moist; mostly fine SAND; (+#4=0%, -#200=7.3%).												
	30				S07	6 11 16	27	4	99		83				
	31		Medium dense.												

Boring terminated at planned depth.
Bottom of borehole at 31.5 ft bgs.

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MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

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Plate: A-5B

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
L.S. Bhangoo	**11-1-11**	**11-1-11**	**36° 47' 36" / -119° 51' 40"**	**S0005A**

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Technicon Engineering Services, Inc.	**STA 1967+50**	
DRILLING METHOD	DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger	**CME 55**	**8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)	SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
MC (2.5" I.D.) - SPT (1.4" I.D.)	**140 lbs**	**87%**
BOREHOLE BACKFILL AND COMPLETION	GROUNDWATER READINGS — DURING DRILLING; AFTER DRILLING (DATE) **35.0 ft on 11-1-11**	TOTAL DEPTH OF BORING
NEAT CEMENT		**121.5 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Remarks
	0	SILTY SAND (SM); very dense; light brown; moist; mostly fine SAND.									
	2	SILTY SAND with GRAVEL (SM); very dense; light brown; moist; little fine GRAVEL; mostly fine SAND; (+#4=17.6%, -#200=32.5%). (+#4=12.1%, -#200=37.2%).	S01	6 50/6"	50/6	4			56		PA
	3.5	SANDY lean CLAY (CL); very stiff; reddish brown; moist; little fine SAND; low to medium plasticity fines.									PA, R, CP (Bulk 2'-5') PA
	5		S02	6 8 13	21	14		PP = 2.5	100		
	6	Lean CLAY (CL); very stiff; reddish brown; moist; medium plasticity fines.									PI, CR PI
	8	SILT with SAND (ML); very stiff; light grayish brown; moist; some fine SAND.									
	10	(+#4=0%, -#200=71.7%).	S03	7 12 16	28	12	103	PP = 2.5	72		PA
	13	SILTY SAND (SM); dense; yellowish brown; moist; mostly fine SAND.									
	15	Dense.	S04	7 8 16	24	17			89		PA
	20	Medium dense.	S05	5 6 10	16	16			100		
	23	CLAYEY SAND (SC); dense; light yellowish brown; moist; mostly fine SAND.									
	25										

(continued)

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MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-6A

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25		SANDY SILT (ML); hard; light yellowish brown; moist; mostly fine SAND; (-#200=66.8%).		S06	12 18 22	40	23			100				PA
	28		SILTY SAND (SM); dense; yellowish brown; moist; mostly medium SAND; few fines.												
	30		Poorly graded SAND (SP); dense; light brown; moist; mostly medium SAND.		S07	9 16 20	36	4	101		89				DS
	35		Medium dense; wet.		S08	5 7 13	20	23			89				
	40				S09	9 14 16	30	24			100				PA
	41		Poorly graded SAND with SILT (SP-SM); dense; yellowish brown; wet; mostly medium SAND; (+#4=0%, -#200=5.6%).												
	45		Medium dense.		S10	9 9 10	19	23			89				
	50				S11	17 25 33	58	6	104		83				
	51		SILTY SAND (SM); very dense; yellowish brown; wet; mostly medium SAND; few fines; yellowish brown to light gray.												
	55														

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

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Plate: A-6B

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
			SILTY SAND (SM) *(continued)*.		S12	10 11 13	24	21			100				PA
	56		Poorly graded SAND with SILT (SP-SM); dense; yellowish brown; wet; mostly fine SAND; (+#4=0%, -#200=6.5%).												
	57														
	58														
	59														
	60		Mostly medium to fine SAND.		S13	11 14 16	30	20			89				
	61														
	62														
	63														
	64														
	65				S14	18 27 30	57	9	102		78				DS
	66		SILTY SAND (SM); dense; light gray; wet; mostly fine SAND.												
	67														
	68														
	69														
	70				S15	8 11 33	44	30		PP = 3.25	83				PA
	71		SILT with SAND (ML); very stiff; light gray; wet; mostly fine SAND; (+#4=0%, -#200=77.3%).												PA
	72														
	73														
	74														
	75				S16	21 27 30	57	23	105		78				
	76		Hard.												
	77														
	78														
	79														
	80				S17	50/6"	REF	33			33				
	81		SILTY SAND (SM); very dense; light gray; wet; mostly fine SAND; (+#4=14.2%, -#200=16.0%).												PA
	82														
	83														
	84														
	85														

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

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Plate: A-6C

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	85		SILTY SAND (SM) *(continued)*.		S18	20 21 21	42	22			72				PA
	86		Poorly graded SAND with SILT (SP-SM); very dense; dark brown; wet; mostly fine SAND; (+#4=0%, -#200=10.6%).												
	88		SANDY lean CLAY (CL); very stiff; brown; wet; little fine SAND; low plasticity fines.												
	90				S19	28 50/2"	50/2	32			44				
	91		SILT with SAND (ML); hard; light grayish brown; wet; mostly fine SAND.												
	95				S20	21 50/5"	50/5	31	89	PP = >4	44				
	100		SILTY SAND (SM); very dense; light grayish brown; moist; mostly fine SAND; (+#4=0%, -#200=43.8%).		S21	30 34 51	85	27		PP = 1.75	72				PA
	105		Dense; yellowish brown; mostly medium to fine SAND; weak cementation.		S22	9 17 37	54	23	101		78				DS
	110				S23	17 17 18	35	24			72				
	111		SILT with SAND (ML); very stiff; light yellowish brown; wet; some fine SAND.												

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011

Job No.: 2009-138-400

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Plate: A-6D

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	116		CLAYEY SAND (SC); very dense; light yellowish brown; wet; mostly fine SAND. *layer description continued from previous page*		S24	13 27 35	62	47			83				PA
	117–118		SILT with SAND (ML); very stiff; light yellowish brown; wet; mostly fine SAND; (+#4=0%, -#200=71.6%).												
	119		Lean CLAY with SAND (CL); hard; light yellowish brown; wet; some fine SAND; low to medium plasticity fines.												
	120–121				S25	22 36 50/5"	86/11	31	84	PP = 2	72				

Boring terminated at planned depth.
Bottom of borehole at 121.5 ft bgs.

Depth scale: 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145

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MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

Plate: A-6E

LOGGED BY **L.S. Bhangoo**	BEGIN DATE **10-31-11**	COMPLETION DATE **10-31-11**	BOREHOLE LOCATION (Lat/Long or North/East and Datum) **36° 47' 59" / -119° 52' 5"**	HOLE ID **S0006A**
DRILLING CONTRACTOR **Technicon Engineering Services, Inc.**			BOREHOLE LOCATION (Offset, Station, Line) **STA 1939+50**	SURFACE ELEVATION
DRILLING METHOD **Hollow-Stem Auger**			DRILL RIG **CME 55**	BOREHOLE DIAMETER **8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID) **MC (2.5" I.D.) - SPT (1.4" I.D.)**			SPT HAMMER TYPE **140 lbs**	HAMMER EFFICIENCY, ERi **87%**
BOREHOLE BACKFILL AND COMPLETION **NEAT CEMENT**			GROUNDWATER READINGS DURING DRILLING AFTER DRILLING (DATE) **Not encountered on 10-31-2011**	TOTAL DEPTH OF BORING **31.5 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Remarks
	0	SILTY SAND (SM); medium dense; reddish brown; moist; mostly fine SAND.									
	2.5		S01	12, 6, 8	14				100		
	4	(+#4=0%, -#200=33.1%).									R, PA, CP (Bulk 2'-5') PA
	5		S02	13, 35, 26	61	11			100		
	6	Very dense; yellowish brown; mostly fine SAND.									CR
	10		S03	2, 4, 7	11	6	101		100		
	11	Medium dense; trace fine GRAVEL; mostly fine SAND; (+#4=4.3%, -#200=16.8%).									PA
	15		S04	4, 6, 5	11	4	98		89		
	16	Poorly graded SAND (SP); loose; yellowish brown to light gray; moist; mostly fine SAND.									DS
	18	SANDY lean CLAY (CL); very stiff; brown; moist; low to medium plasticity fines.									
	20		S05	2, 5, 14	19	17			72		
	21	Lean CLAY (CL); very stiff; black; moist; medium plasticity fines.									PI
	23	SILTY SAND (SM); very dense; light grayish brown; moist; mostly fine SAND.									

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25–26		SILTY SAND (SM); very dense; light grayish brown; moist; mostly fine SAND. *layer description continued from previous page*		S06	6 30 44	74	11			72				PA
	26–31.5		SILTY SAND (SM) *(continued)*. SANDY SILT (ML); hard; light grayish brown; moist; mostly fine SAND; (+#4=0%, -#200=67.4%).												
	30				S07	6 21 50/3"	71/9	30	92	PP = >4	78				

Depth scale (ft): 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55

Boring terminated at planned depth.
Bottom of borehole at 31.5 ft bgs.

FLY CALIFORNIA
Without ever leaving the ground

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

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Plate:

A-7B

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
L.S. Bhangoo	**10-31-11**	**10-31-11**	**36° 48' 13" / -119° 52' 21"**	**S0007A**
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Technicon Engineering Services, Inc.			**STA 1917+50**	
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			**CME 55**	**8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
MC (2.5" I.D.) - SPT (1.4" I.D.)			**140 lbs**	**87%**
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS — DURING DRILLING — AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
NEAT CEMENT			**Not encountered on 10-31-2011**	**31.5 ft**

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	0		SILTY SAND (SM); very dense; reddish brown; moist; mostly fine SAND; moderate to strong cementation.												
	2				S01	2 13 50/5"	63/11			PP = >4	61				
	3		(+#4=0%, -#200=30.4%).					7	117						PA
	4		Trace fine GRAVEL; (+#4=4%, -#200=26.3%).												PA
	5		Medium dense; grayish brown.		S02	9 6 4	10	13			89				
	6														CR
	10				S03	6 7 10	17	20			100				
	15				S04	13 50/5"	50/5			PP = >4	56				
	16		Very dense; light yellowish brown; mostly coarse to medium SAND; (+#4=0%, -#200=29.7%).					8	120						PA
	20				S05	3 9 12	21	2			100				
	21		Medium dense; yellowish brown; mostly fine SAND.												
	25														

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25		SILTY SAND (SM); very dense; reddish brown; moist; mostly fine SAND; moderate to strong cementation. *layer description continued from previous page* SILTY SAND (SM) *(continued)*.		S06	3 9 12	21	3			100				PA
	26–30		Poorly graded SAND (SP); medium dense; light grayish brown; mostly fine SAND; trace fines; (+#4=0%, -#200=4.6%).												
	30–31.5		Mostly medium to fine SAND.		S07	7 13 16	29	3	95		89				DS

Boring terminated at planned depth.
Bottom of borehole at 31.5 ft bgs.

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

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Plate: A-8B

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
L.S. Bhangoo	**10-27-11**	**10-27-11**	**36° 48' 30" / -119° 52' 41"**	**S0008A**

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Technicon Engineering Services, Inc.	**STA 1894+50**	
DRILLING METHOD	DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger	**CME 55**	**8.5 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)	SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
MC (2.5" I.D.) - SPT (1.4" I.D.)	**140 lbs**	**87%**
BOREHOLE BACKFILL AND COMPLETION	GROUNDWATER READINGS — DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
NEAT CEMENT	**105.0 ft on 10-27-11**	**121.5 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Remarks
	0	SILTY SAND (SM); very dense; yellowish brown; moist; mostly fine SAND; moderate cementation.									
	2		S01	18 60/6"	60/6	4	125		56		
	4	(+#4=8%, -#200=31.2%).									PA, EI, R, CP (Bulk 2'-5')
	4.5	CLAYEY SAND (SC); very dense; reddish brown; moist; mostly fine SAND.									PA
	5		S02	15 18 20	38	9			61		
	6	SANDY SILT (ML); stiff; reddish brown; moist; mostly fine SAND; mostly fines; (-#200=49.90%).									PA
	8.5	Lean CLAY (CL); very stiff; light grayish brown; moist; low to medium plasticity fines.									
	10	SILT (ML); hard; light grayish brown; moist.	S03	5 12 29	41	33			78		PI, CR PI
	15		S04	6 26 22	48	25	96	PP = >4.5	72		
	16.5	SILTY SAND (SM); dense; reddish brown; moist; mostly fine SAND.									
	20	Very dense; light grayish brown; (+#4=0%, -#200=37.4%).	S05	6 24 39	63	7	104		72		PA
	25										

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-9A

PCI-CT 5 BR COPY OF 2009-138-400.GPJ DATA TEMPLATE.GDT 12/12/11

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25		SILTY SAND (SM); dense; reddish brown; moist; mostly fine SAND. *layer description continued from previous page* Olive brown. SILTY SAND (SM) *(continued)*.		S06	17 32 43	75	12 7	114		78				DS PA
	30		Dense; yellowish brown.		S07	7 11 16	27	4			100				
	35		Very dense; light grayish brown; (+#4=2.4%, -#200=14.6%).		S08	10 22 42	64				89				PA
	40		Reddish brown.		S09	7 38 42	80	16			89				
	45				S10	20 22 36	58	10	123		72				
	50		Well-graded SAND with SILT (SW-SM); dense; light grayish brown; moist; mostly medium to fine SAND; (+#4=0%, -#200=8.8%).		S11	6 13 14	27	3			89				PA
	55														

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	55–60		Medium dense; little fine GRAVEL. Well-graded SAND with SILT (SW-SM) *(continued)*. Well-graded SAND with SILT (SW-SM); dense; light grayish brown; moist; mostly medium to fine SAND; (+#4=0%, -#200=8.8%). *layer description continued from previous page*		S12	4 8 13	21	23			83				
	60–65		Very dense; little fines.		S13	13 20 36	56	16			89				
	65–68		SILT (ML); hard; light brown; moist; mostly fines; (-#200=88.3%).		S14	17 32 46	78	32	91		78				PA
	68–70		Little fine GRAVEL; some coarse to medium SAND.												
	70–74		Poorly graded SAND (SP); dense; light brown; moist; mostly coarse to medium SAND.		S15	10 24 24	48	2	98		78				DS
	74–76		SILT with SAND (ML); hard; gray; moist; mostly fine SAND.		S16	25 33 28	61	19			89				
	76–78.5		SANDY SILT (ML); hard; gray; moist; mostly fine SAND.												
	78.5–81		Lean CLAY (CL); hard; light brown; moist; low to medium plasticity fines.		S17	19 60/3"	60/3				50				UU
	81–85		SILT with SAND (ML); hard; yellowish brown; moist; mostly fine SAND.												

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-9C

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	86		SILT with SAND (ML) *(continued)*. SILT with SAND (ML); hard; yellowish brown; moist; mostly fine SAND. *layer description continued from previous page*		S18	3 23 25	48	20	75		72				PI
	87														
	88		SILTY SAND (SM); very dense; light brown; moist; mostly fine SAND.												
	89														
	90				S19	17 27 34	61				78				DS
	91														
	92														
	93														
	94		SILT with SAND (ML); very stiff; light gray; moist; mostly fine SAND.												
	95		SANDY SILT (ML); hard; light gray; moist; mostly fine SAND; (+#4=0%, -#200=52.2%).		S20	9 18 18	36	13			78				PA
	96														
	97														
	98		SILTY SAND (SM); very dense; light gray; moist; mostly fine SAND.												
	99														
	100				S21	13 28 32	60	17	91		72				
	101														
	102														
	103														
	104														
	105		Well-graded SAND with SILT (SW-SM); very dense; brown; wet; mostly medium to fine SAND; (+#4=0%, -#200=8.1%).		S22	14 23 32	55	12			83				PA
	106														
	107														
	108														
	109														
	110				S23	11 26 33	59	15			72				
	111														
	112														
	113														
	114														
	115														

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

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Plate: A-9D

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	116		SILTY SAND (SM); very dense; dark brown; mostly fine SAND; (+#4=1%, -#200=44.0%). *layer description continued from previous page*		S24	9 30 28	58	34			72				PA
	120				S25	32 60/6"	60/6	21			67				

Boring terminated at planned depth.
Bottom of borehole at 121.5 ft bgs.

Depth scale: 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

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Plate: A-9E

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
L.S. Bhangoo	**10-28-11**	**10-28-11**	**36° 48' 53" / -119° 53' 12"**	**S0009R**

DRILLING CONTRACTOR	BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Technicon Engineering Services, Inc.	**STA 1858+50**	**0.0 ft**
DRILLING METHOD	DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger	**CME 55**	**8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID)	SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
MC (2.5" I.D.) - SPT (1.4" I.D.)	**140 lbs**	**87%**
BOREHOLE BACKFILL AND COMPLETION	GROUNDWATER READINGS — DURING DRILLING — AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
NEAT CEMENT	**18.0 ft on 10-28-11**	**111.5 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Remarks
	0	SILTY SAND (SM); dense; reddish brown; moist; mostly fine SAND; moderate cementation.									
-2.00	2		S01	7 19 27	46	3	114		78		PA
	3	(+#4=0%, -#200=19.9%).									PA
-4.00	4	Trace fine GRAVEL; (+#4=4.3%, -#200=24.5%).									R, PA, CP (Bulk 2'-5') PA
	5	Medium dense; little fine GRAVEL.	S02	4 6 6	12	7			72		
-6.00	6										CR
-10.00	10	Medium dense; light reddish brown.	S03	5 6 5	11	8			44		
	15	Well-graded SAND with SILT (SW-SM); loose; light reddish brown; moist; mostly fine SAND; (+#4=3.5%, -#200=11.2%).	S04	2 3 4	7	10			56		
-16.00	16										PA
-18.00	18										
-20.00	20	Dense; light grayish brown; mostly medium to fine SAND.	S05	7 17 14	31	12			67		
	23	Lean CLAY with SAND (CL); hard; light grayish brown; moist; some fine SAND; low to medium plasticity fines.									
-24.00	24										
	25										

(continued)

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25		Lean CLAY with SAND (CL) *(continued)*.		S06	17 42 44	86	24	100	PP = >4	72				
-26.00	26		SILT (ML); hard; light grayish brown; moist.												
	27														
-28.00	28		CLAYEY SAND (SC); very dense; light grayish brown; moist; mostly fine SAND.												
	29														
-30.00	30				S07	23 37 35	72	28	95	PP = >4	78				PA
	31		SILT (ML); hard; light grayish brown; moist; mostly fines; (+#4=0%, -#200=88.2%).												
-32.00	32														
	33		SILT with SAND (ML); hard; light grayish brown; wet; mostly fine SAND.												
-34.00	34														
	35				S08	9 28 25	53	22		PP = 1.75	89				
-36.00	36														
	37														
-38.00	38		CLAYEY SAND (SC); very dense; light brown; wet; mostly fine SAND.												
	39														
-40.00	40		SILT (ML); hard; light grayish brown; wet; mostly fine SAND.		S09	16 43 49	92	22	106	PP = >4	72				
	41														
-42.00	42														
	43		SILT with SAND (ML); hard; light grayish brown; moist; mostly fine SAND.												
-44.00	44														
	45				S10	24 60/3"	60/3	27	97	PP = >4	50				
-46.00	46														
	47														
-48.00	48														
	49		CLAYEY SAND (SC); very dense; reddish brown; moist; little fine GRAVEL; mostly fine SAND; some fines.												
-50.00	50		SILTY SAND (SM); very dense; light reddish brown; wet; mostly medium to fine SAND; (-#200=43.5%).		S11	11 19 21	40	41			78				PA
	51														
-52.00	52														
	53														
-54.00	54														
	55														

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-10B

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
-56.00	56		SILTY SAND (SM) *(continued)*. SILTY SAND (SM); very dense; light reddish brown; wet; mostly medium to fine SAND; (-#200=43.5%). *layer description continued from previous page*		S12	28 37 34	71				83				
	57														
-58.00	58														
	59														
-60.00	60		Dense; light grayish brown; mostly fine SAND.		S13	10 14 16	30	12			78				
	61														
-62.00	62														
	63														
-64.00	64														
	65		Very dense.		S14	17 18 20	38	16			89				
-66.00	66														
	67														
-68.00	68														
	69														
-70.00	70		Very dense; reddish brown.		S15	14 25 37	62	18			83				
	71														
-72.00	72														
	73														
-74.00	74														
	75		Olive brown; mostly medium to fine SAND.		S16	52 60/4"	60/4	15	107		56				
-76.00	76														DS
	77														
-78.00	78														
	79														
-80.00	80		SILT (ML); hard; light grayish brown; wet; mostly fines; (+#4=0%, -#200=93.3%).		S17	11 18 30	48	29			78				
	81														PA
-82.00	82														
	83														
-84.00	84														
	85														

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

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Plate: A-10C

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
-86.00	86		CLAYEY SAND (SC); very dense; light grayish brown; wet; little fine GRAVEL; mostly medium to fine SAND; (+#4=14.6%, -#200=36.3%). *layer description continued from previous page*		S18	34 50/6"	50/6	25			61				PA
	87														
-88.00	88														
	89		SANDY lean CLAY (CL); hard; light grayish brown; wet; little fine GRAVEL; some fine SAND; low to medium plasticity fines.												
-90.00	90				S19	33 60/5"	60/5	28		PP = 1.5	56				
	91		SILT with SAND (ML); hard; light grayish brown; wet; mostly fine SAND.												
-92.00	92														
	93														
-94.00	94														
	95		SANDY SILT (ML); hard; light grayish brown; wet; some fine SAND; mostly fines; (+#4=0%, -#200=64.1%).		S20	38 60/6"	60/6	25	88		61				PA
-96.00	96														
	97														
-98.00	98		SILTY SAND (SM); very dense; light grayish brown; wet; mostly medium to fine SAND.												
	99														
-100.00	100		Mostly fine SAND.		S21	16 24 27	51	17			72				
	101														
-102.00	102														
	103														
-104.00	104														
	105														
-106.00	106														
	107														
-108.00	108														
	109														
-110.00	110		Medium dense; light gray; wet; mostly coarse to fine SAND.		S23	8 9 9	18	74			72				
	111														
-112.00	112														
	113		Boring terminated at planned depth. Bottom of borehole at 111.5 ft bgs.												
-114.00	114														
	115														

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 Job No.: 2009-138-400

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:

A-10D

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
L.S. Bhangoo	**10-31-11**	**10-31-11**	**36° 49' 9" / -119° 53' 36"**	**S0010A**
DRILLING CONTRACTOR **Technicon Engineering Services, Inc.**			BOREHOLE LOCATION (Offset, Station, Line) **STA 1834+00**	SURFACE ELEVATION
DRILLING METHOD **Hollow-Stem Auger**			DRILL RIG **CME 55**	BOREHOLE DIAMETER **8 in**
SAMPLER TYPE(S) AND SIZE(S) (ID) **MC (2.5" I.D.) - SPT (1.4" I.D.)**			SPT HAMMER TYPE **140 lbs**	HAMMER EFFICIENCY, ERi **87%**
BOREHOLE BACKFILL AND COMPLETION **NEAT CEMENT**			GROUNDWATER READINGS — DURING DRILLING — AFTER DRILLING (DATE) **Not encountered on 10-31-2011**	TOTAL DEPTH OF BORING **31.5 ft**

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Remarks
	0	SILTY SAND (SM); very dense; reddish brown; moist; mostly fine SAND; moderate cementation.									
	2.5		S01	5 29 50/3"	79/9				78		
	3	(+#4=0%, -#200=27.3%).									PA, CL
	4	(+#4=1.3%, -#200=31.7%).									R, CP, PA (Bulk 2'-5') PA
	5	Medium dense.	S02	10 5 6	11	4			100		
	6										CR
	10	Poorly graded SAND with SILT (SP-SM); medium dense; reddish brown; moist; trace fine GRAVEL; mostly fine SAND; few fines; (+#4=4.3%, -#200=8.0%).	S03	3 8 6	14	3			89		PA
	15	Poorly graded SAND (SP); medium dense; light brown; moist; mostly coarse to medium SAND.	S04	3 7 9	16	3	98		100		DS
	20	Poorly graded SAND with SILT (SP-SM); medium dense; yellowish brown; mostly fine SAND.	S05	5 7 5	12	2			100		
	25										

(continued)

MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Depth	Sample Number	Blows per 6 in.	Blows per foot	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Recovery (%)	RQD (%)	Drilling Method	Casing Depth	Remarks
	25		Poorly graded SAND with SILT (SP-SM); medium dense; yellowish brown; mostly fine SAND. *layer description continued from previous page* Dense; trace fine GRAVEL; (+#4=3.5%, -#200=5.2%). Poorly graded SAND with SILT (SP-SM) *(continued)*.		S06	4 12 14	26	2	138		89				PA
	30		Very dense; little fine GRAVEL.		S07	34 50/3"	50/3	8	111		50				

Boring terminated at planned depth.
Bottom of borehole at 31.5 ft bgs.

Depth scale: 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55

PCI-CT 5 BR COPY OF 2009-138-400.GPJ DATA TEMPLATE.GDT 12/12/11

FLY CALIFORNIA Without ever leaving the ground

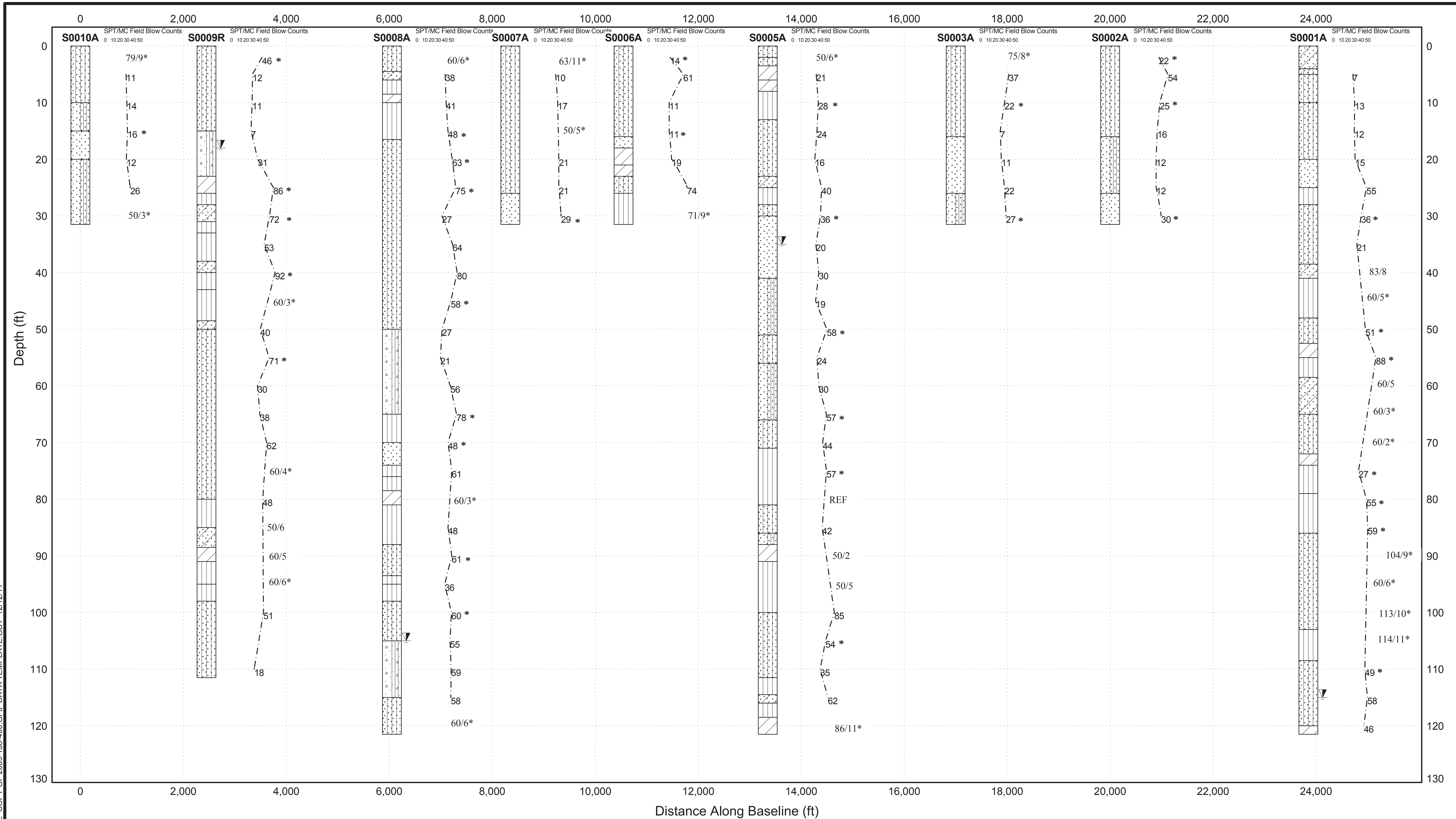
MINIMUM ARRA-FUNDED SEGMENT

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011 | Job No.: 2009-138-400

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-11B



USCS Clayey Sand
USCS Silt
USCS Well-graded Sand with silt
USCS Silty Sand
USCS Lean Clay
USCS Poorly Graded Sand
USCS Poorly Graded Sand with silt

* Indicates Modified California Sampler (MC) blow counts per foot.

Static Water Level Reading

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

SUBSURFACE DIAGRAM: CROSS-SECTION

Minimum ARRA-funded Segment

Merced to Fresno Section of the California High-Speed Train Project,

Date: 10/26/2011	Job No.: 2009-138-400	Plate: A-12

PCI STRATIGRAPHY & GW - B SIZE COPY OF 2009-138-400.GPJ DATA TEMPLATE.GDT 12/12/11

GREGG DRILLING & TESTING, INC.

GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

October 28, 2011

Parikh Consultants
Attn: Frank Li

Subject: CPT Site Investigation
California High Speed Rail
, California
GREGG Project Number: 11-632SH

Dear Mr. Li:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☒
4	UVOST Laser Induced Fluorescence	(UVOST)	☐
5	Groundwater Sampling	(GWS)	☐
6	Soil Sampling	(SS)	☐
7	Vapor Sampling	(VS)	☐
8	Pressuremeter Testing	(PMT)	☐
9	Vane Shear Testing	(VST)	☐
10	Dilatometer Testing	(DMT)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (562) 427-6899.

Sincerely,

Peter Robertson
Technical Director, Gregg Drilling & Testing, Inc.

2726 Walnut Ave • Signal Hill, California 90755 • (562) 427-6899 • FAX (562) 427-3314
OTHER OFFICES: SAN FRANCISCO • HOUSTON
www.greggdrilling.com

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (Feet)	Depth of Groundwater Samples (Feet)	Depth of Soil Samples (Feet)	Depth of Pore Pressure Dissipation Tests (Feet)
SCPT-4	10/27/11	76	-	-	71.0

Bibliography

Lunne, T., Robertson, P.K. and Powell, J.J.M., “Cone Penetration Testing in Geotechnical Practice” E & FN Spon. ISBN 0 419 23750, 1997

Roberston, P.K., “Soil Classification using the Cone Penetration Test”, Canadian Geotechnical Journal, Vol. 27, 1990 pp. 151-158.

Mayne, P.W., “NHI (2002) Manual on Subsurface Investigations: Geotechnical Site Characterization”, available through www.ce.gatech.edu/~geosys/Faculty/Mayne/papers/index.html, Section 5.3, pp. 107-112.

Robertson, P.K., R.G. Campanella, D. Gillespie and A. Rice, “Seismic CPT to Measure In-Situ Shear Wave Velocity”, Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8, 1986 pp. 791-803.

Robertson, P.K., Sully, J., Woeller, D.J., Lunne, T., Powell, J.J.M., and Gillespie, D.J., "Guidelines for Estimating Consolidation Parameters in Soils from Piezocone Tests", Canadian Geotechnical Journal, Vol. 29, No. 4, August 1992, pp. 539-550.

Robertson, P.K., T. Lunne and J.J.M. Powell, “Geo-Environmental Application of Penetration Testing”, Geotechnical Site Characterization, Robertson & Mayne (editors), 1998 Balkema, Rotterdam, ISBN 90 5410 939 4 pp 35-47.

Campanella, R.G. and I. Weemees, “Development and Use of An Electrical Resistivity Cone for Groundwater Contamination Studies”, Canadian Geotechnical Journal, Vol. 27 No. 5, 1990 pp. 557-567.

DeGroot, D.J. and A.J. Lutenegger, “Reliability of Soil Gas Sampling and Characterization Techniques”, International Site Characterization Conference - Atlanta, 1998.

Woeller, D.J., P.K. Robertson, T.J. Boyd and Dave Thomas, “Detection of Polyaromatic Hydrocarbon Contaminants Using the UVIF-CPT”, 53rd Canadian Geotechnical Conference Montreal, QC October pp. 733-739, 2000.

Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, “Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers” BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

Copies of ASTM Standards are available through www.astm.org

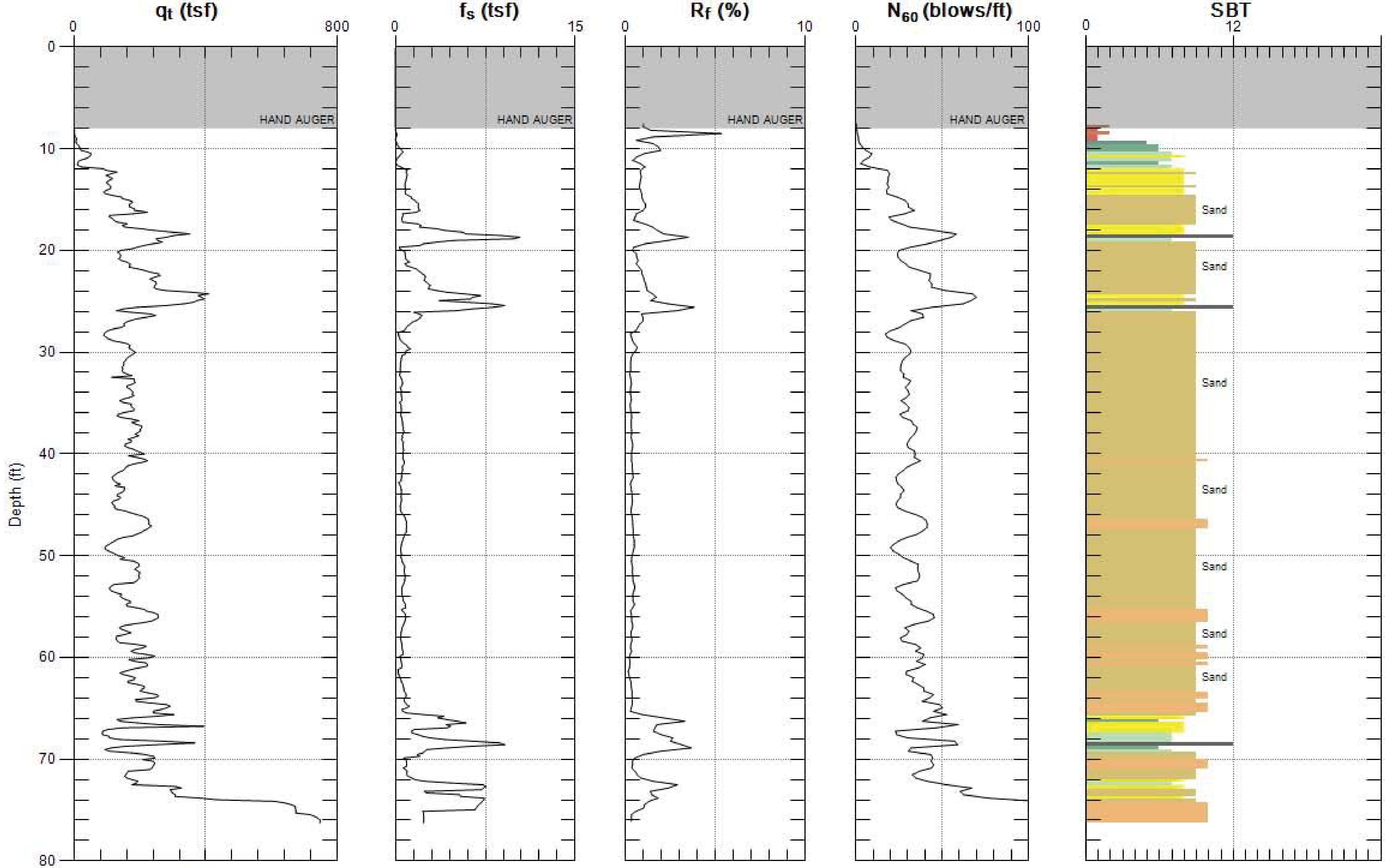
PARIKH CONSULTANTS

Site: CHSR

Sounding: SCPT-4

Engineer: F.LI

Date: 10/27/2011 01:55



Max. Depth: 76.280 (ft)
Avg. Interval: 0.328 (ft)

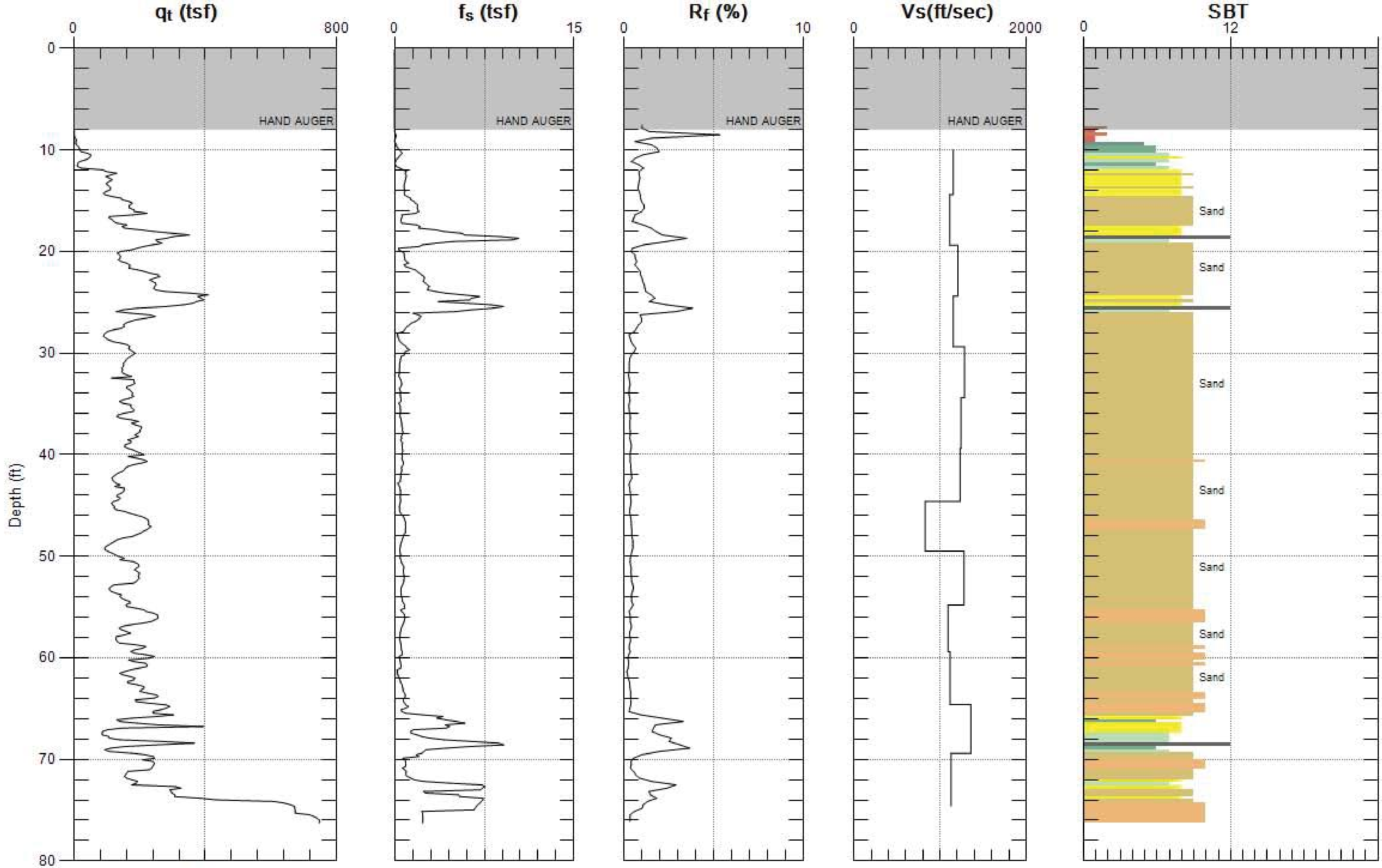
SBT: Soil Behavior Type (Robertson 1990)

GREGG

PARIKH CONSULTANTS

Site: CHSR
Sounding: SCPT-4

Engineer: F.LI
Date: 10/27/2011 01:55



Max. Depth: 76.280 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

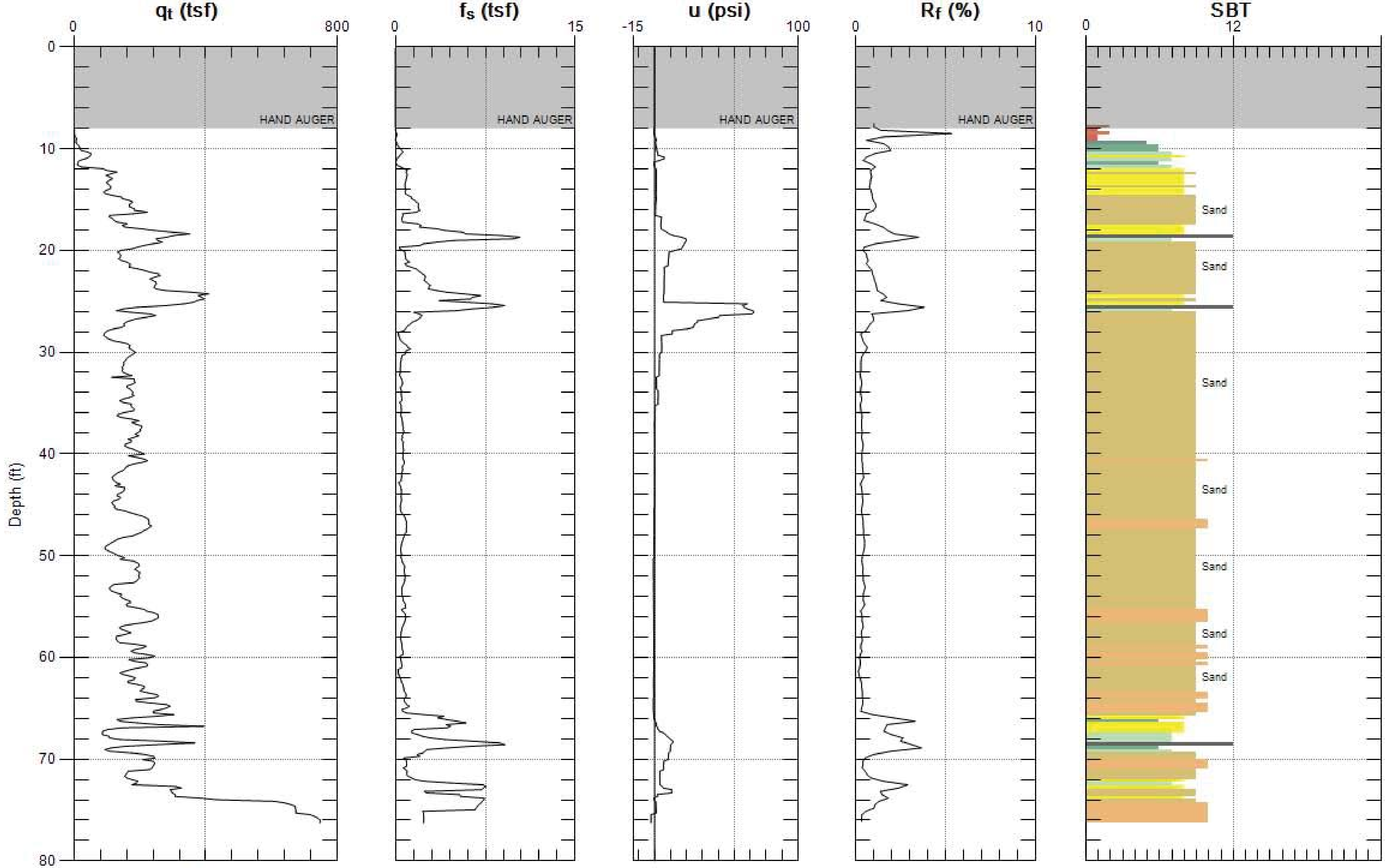
PARIKH CONSULTANTS

Site: CHSR

Sounding: SCPT-4

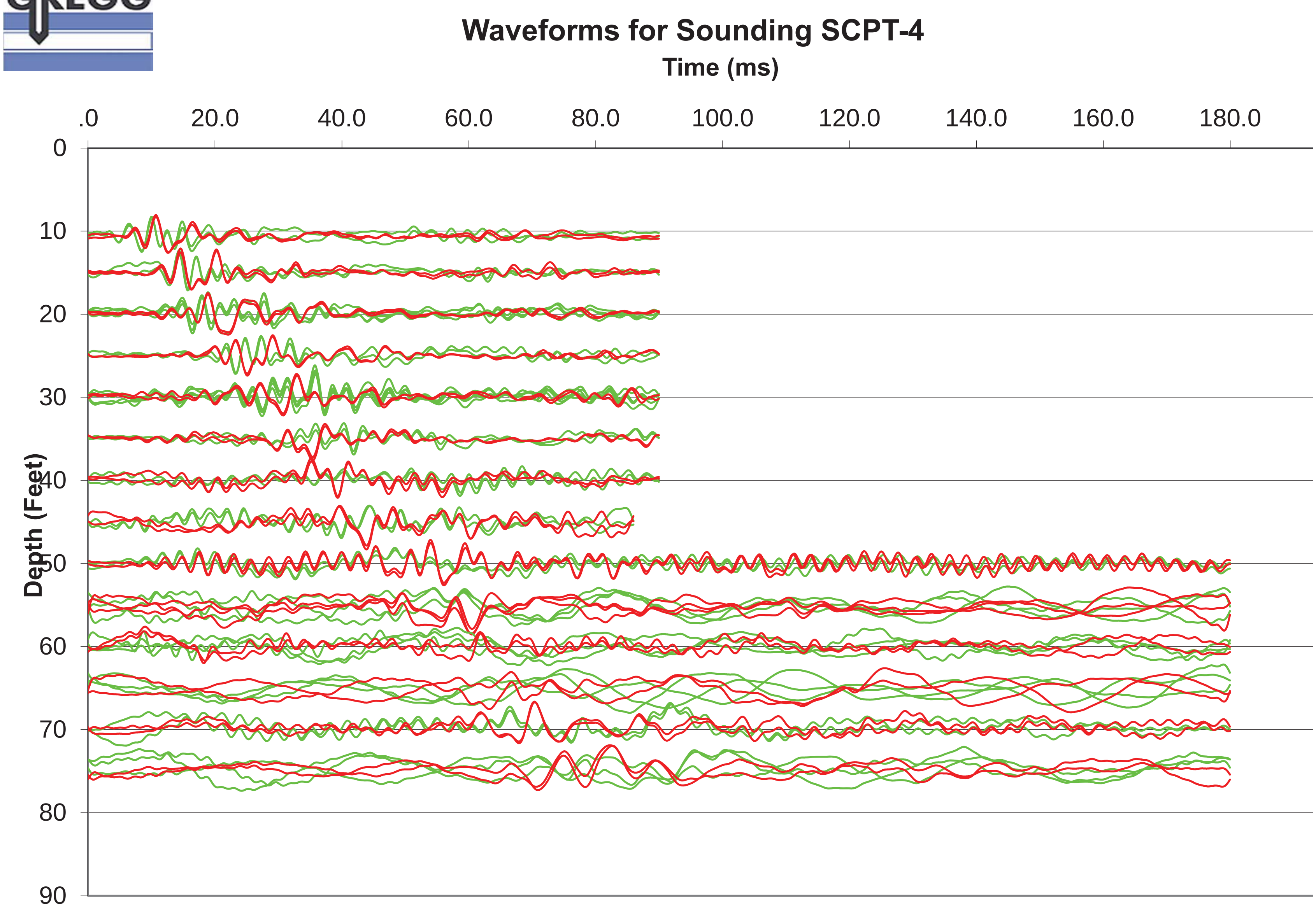
Engineer: F.LI

Date: 10/27/2011 01:55



Max. Depth: 76.280 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)


Waveforms for Sounding SCPT-4
Time (ms)
.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
Depth (Feet)
0
10
20
30
40
50
60
70
80
90

Shear Wave Velocity Calculations

CHSR
SCPT-4

Geophone Offset: 0.66 Feet
Source Offset: 1.67 Feet

10/27/11

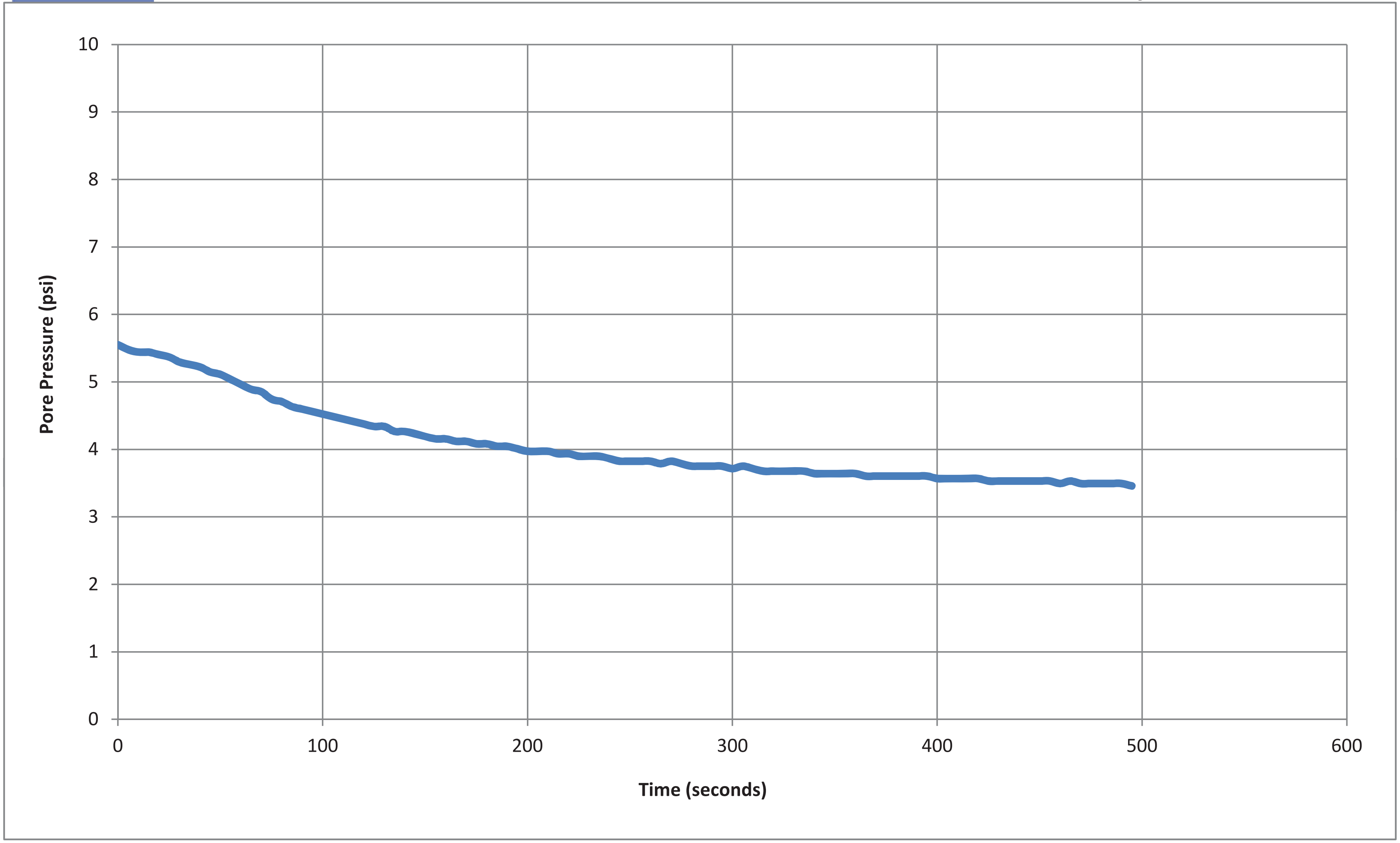
Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
10.66	10.00	10.14	10.14	10.7000			
15.09	14.43	14.53	4.39	14.5000	3.8000	1154.5	12.22
20.01	19.35	19.42	4.90	18.9000	4.4000	1112.9	16.89
25.10	24.44	24.50	5.07	23.1000	4.2000	1207.2	21.90
30.02	29.36	29.41	4.91	27.3500	4.2500	1155.7	26.90
35.10	34.44	34.49	5.08	31.3000	3.9500	1285.6	31.90
40.03	39.37	39.40	4.92	35.2500	3.9500	1244.6	36.91
45.28	44.62	44.65	5.25	39.5000	4.2500	1234.2	41.99
50.20	49.54	49.56	4.92	45.4500	5.9500	826.6	47.08
55.45	54.79	54.81	5.25	49.5500	4.1000	1279.7	52.16
60.04	59.38	59.40	4.59	53.7500	4.2000	1093.1	57.08
65.29	64.63	64.65	5.25	58.4500	4.7000	1116.5	62.00
70.05	69.39	69.41	4.76	61.9500	3.5000	1358.8	67.01
75.30	74.64	74.65	5.25	66.6000	4.6500	1128.6	72.01

GREGG

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: SCPT-4
Depth: 71.03 ft
Site: CHSR
Engineer: F.LI



Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*. The soundings were conducted using a 20 ton capacity cone with a tip area of 15 cm^2 and a friction sleeve area of 225 cm^2. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.80.

The cone takes measurements of cone bearing (q_c), sleeve friction (f_s) and penetration pore water pressure (u_2) at 5-cm intervals during penetration to provide a nearly continuous log. CPT data reduction and interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored on disk for further analysis and reference. All CPT soundings are performed in accordance with revised (2007) ASTM standards (D 5778-07).

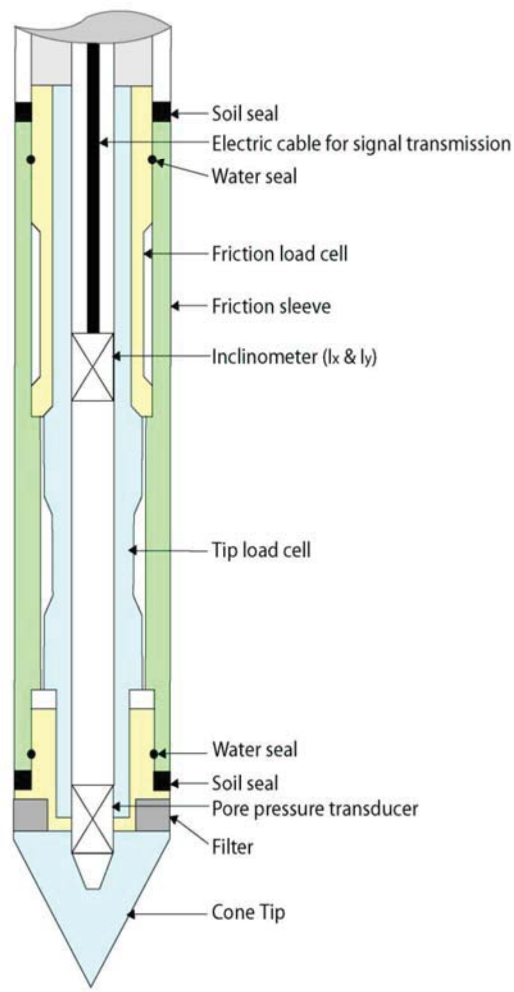


Figure CPT

The cone also contains a porous filter element located directly behind the cone tip (u_2). It consists of porous plastic and is 5.0mm thick. The filter element is used to obtain penetration pore pressure as the cone is advanced as well as Pore Pressure Dissipation Tests (*PPDT's*) during appropriate pauses in penetration. It should be noted that prior to penetration, the element is fully saturated with oil under vacuum pressure to ensure accurate and fast dissipation.

The cone has the following accuracy:
1 tsf for q_c, 0.02 tsf for f_s and 0.5 psi for u_2. In soft clays, a lower capacity cone should be used for improved accuracy.

When the soundings are complete, the test holes are grouted. The grouting procedures generally consist of pushing a hollow tremie pipe with a "knock out" plug to the termination depth of the CPT hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

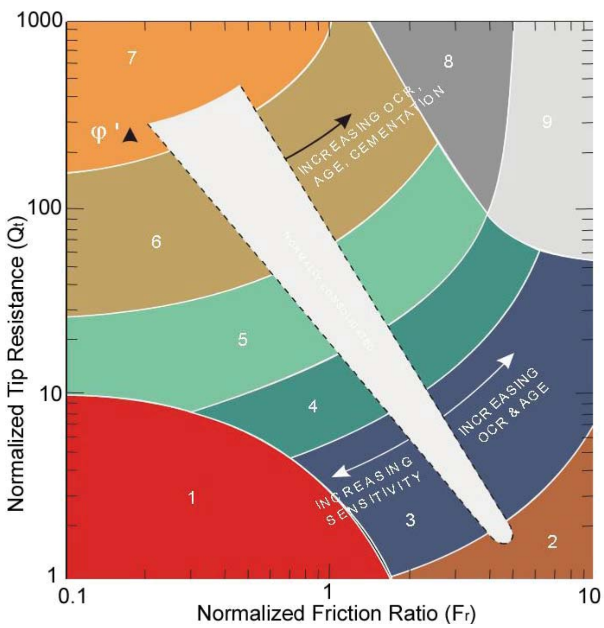
Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected from your site are presented in graphical form in the attached report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings extending greater than 50 feet, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. do not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and do not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on the field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.



(After Robertson, 1990)

Zone	Normailzed Soil Behavior Type
1	sensitive fine grained
2	organic material
3	clay to silty clay
4	clayey silt to silty clay
5	silty sand to sandy silt
6	clean sands to silty sands
7	gravelly sand to sand
8	very stiff sand to clayey sand
9	very stiff fine grained

Figure SBTn

Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected from your site are presented in graphical form in the attached report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings extending greater than 50 feet, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. do not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and do not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

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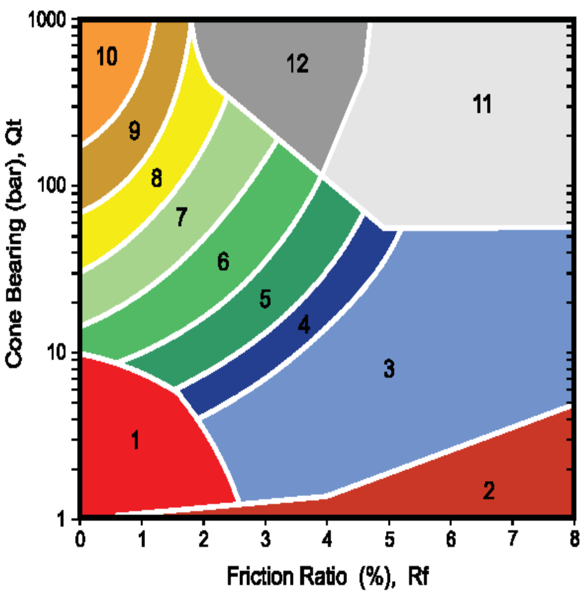


(After Robertson, et al., 1986)

ZONE		SBT
1		Sensitive, fine grained
2		Organic materials
3		Clay
4		Silty clay to clay
5		Clayey silt to silty clay
6		Sandy silt to clayey silt
7		Silty sand to sandy silt
8		Sand to silty sand
9		Sand
10		Gravely sand to sand
11		Very stiff fine grained*
12		Sand to clayey sand*

*over consolidated or cemented

Figure SBT

Cone Penetration Test (CPT) Interpretation

Gregg has recently updated their CPT interpretation and plotting software (2007). The software takes the CPT data and performs basic interpretation in terms of soil behavior type (SBT) and various geotechnical parameters using current published empirical correlations based on the comprehensive review by Lunne, Robertson and Powell (1997). The interpretation is presented in tabular format using MS Excel. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

The following provides a summary of the methods used for the interpretation. Many of the empirical correlations to estimate geotechnical parameters have constants that have a range of values depending on soil type, geologic origin and other factors. The software uses 'default' values that have been selected to provide, in general, conservatively low estimates of the various geotechnical parameters.

Input:

1 Units for display (Imperial or metric) (atm. pressure, pa = 0.96 tsf or 0.1 MPa)
2 Depth interval to average results,(ft or m). Data are collected at either 0.02 or 0.05m and can be averaged every 1, 3 or 5 intervals.
3 Elevation of ground surface (ft or m)
4 Depth to water table, z_w (ft or m) – input required
5 Net area ratio for cone, a (default to 0.80)
6 Relative Density constant, C_{Dr} (default to 350)
7 Young's modulus number for sands, α (default to 5)
8 Small strain shear modulus number
   a. for sands, S_G (default to 180 for SBT_n 5, 6, 7)
   b. for clays, C_G (default to 50 for SBT_n 1, 2, 3 & 4)
9 Undrained shear strength cone factor for clays, N_{kt} (default to 15)
10 Over Consolidation ratio number, k_{ocr} (default to 0.3)
11 Unit weight of water, (default to γ_w = 62.4 lb/ft^3 or 9.81 kN/m^3)

Column

1 Depth, z, (m) – CPT data is collected in meters
2 Depth (ft)
3 Cone resistance, q_c (tsf or MPa)
4 Sleeve friction, f_s (tsf or MPa)
5 Penetration pore pressure, u (psi or MPa), measured behind the cone (i.e. u_2)
6 Other – any additional data, if collected, e.g. electrical resistivity or UVIF
7 Total cone resistance, q_t (tsf or MPa) $q_t = q_c + u\,(1\text{-}a)$

8	Friction Ratio, R_f (%)	$R_f = (f_s/q_t) \times 100\%$
9	Soil Behavior Type (non-normalized), SBT	see note
10	Unit weight, γ (pcf or kN/m^3)	based on SBT, see note
11	Total overburden stress, σ_v (tsf)	$\sigma_{vo} = \gamma\ z$
12	Insitu pore pressure, u_o (tsf)	$u_o = \gamma_w\ (z - z_w)$
13	Effective overburden stress, σ'_{vo} (tsf)	$\sigma'_{vo} = \sigma_{vo} - u_o$
14	Normalized cone resistance, Q_{t1}	$Q_{t1}= (q_t - \sigma_{vo}) / \sigma'_{vo}$
15	Normalized friction ratio, F_r (%)	$F_r = f_s / (q_t - \sigma_{vo}) \times 100\%$
16	Normalized Pore Pressure ratio, B_q	$B_q = u - u_o / (q_t - \sigma_{vo})$
17	Soil Behavior Type (normalized), SBT_n	see note
18	SBT_n Index, I_c	see note
19	Normalized Cone resistance, Q_{tn} (n varies with Ic)	see note
20	Estimated permeability, k_{SBT} (cm/sec or ft/sec)	see note
21	Equivalent SPT N_{60}, blows/ft	see note
22	Equivalent SPT $(N_1)_{60}$ blows/ft	see note
23	Estimated Relative Density, D_r, (%)	see note
24	Estimated Friction Angle, ϕ', (degrees)	see note
25	Estimated Young's modulus, E_s (tsf)	see note
26	Estimated small strain Shear modulus, Go (tsf)	see note
27	Estimated Undrained shear strength, s_u (tsf)	see note
28	Estimated Undrained strength ratio	s_u/σ_v'
29	Estimated Over Consolidation ratio, OCR	see note

Notes:

1 Soil Behavior Type (non-normalized), SBT — Lunne et al. (1997) listed below

2 Unit weight, γ either constant at 119 pcf or based on Non-normalized SBT (Lunne et al., 1997 and table below)

3 Soil Behavior Type (Normalized), SBT_n — Lunne et al. (1997)

4 SBT_n Index, I_c — $I_c = ((3.47 - \log Q_{t1})^2 + (\log F_r + 1.22)^2)^{0.5}$

5 Normalized Cone resistance, Q_{tn} (n varies with Ic)

$Q_{tn} = ((q_t - \sigma_{vo})/pa)\ (pa/(\sigma'_{vo})^n$ and recalculate I_c, then iterate:

When $I_c < 1.64$, $n = 0.5$ (clean sand)
When $I_c > 3.30$, $n = 1.0$ (clays)
When $1.64 < I_c < 3.30$, $n = (I_c - 1.64)0.3 + 0.5$
Iterate until the change in n, $\Delta n < 0.01$

6 Estimated permeability, k_{SBT} (based on Normalized SBT_n)
(Lunne et al., 1997 and table below)

7 Equivalent SPT N_{60}, blows/ft Lunne et al. (1997)

$$\frac{(q_t/p_a)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$

8 Equivalent SPT $(N_1)_{60}$ blows/ft $(N_1)_{60} = N_{60}\, C_N,$
where $C_N = (pa/\sigma'_{vo})^{0.5}$

9 Relative Density, D_r, (%) $D_r^2 = Q_{tn} / C_{Dr}$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

10 Friction Angle, ϕ', (degrees) $\tan\phi' = \frac{1}{2.68}\left[\log\left(\frac{q_c}{\sigma'_{vo}}\right) + 0.29\right]$

Only SBT_n 5, 6, 7 & 8 *Show'N/A' in zones 1, 2, 3, 4 & 9*

11 Young's modulus, E_s $E_s = \alpha\, q_t$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

12 Small strain shear modulus, Go
a. $G_o = S_G (q_t\ \ \sigma'_{vo}\ pa)^{1/3}$ *For SBT_n 5, 6, 7*
b. $G_o = C_G\, q_t$ *For SBT_n 1, 2, 3& 4*
Show 'N/A' in zones 8 & 9

13 Undrained shear strength, s_u $s_u = (q_t - \sigma_{vo}) / N_{kt}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

14 Over Consolidation ratio, OCR $OCR = k_{ocr}\, Q_{t1}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

The following updated and simplified SBT descriptions have been used in the software:

SBT Zones		**SBT_n Zones**	
1	sensitive fine grained	1	sensitive fine grained
2	organic soil	2	organic soil
3	clay	3	clay
4	clay & silty clay	4	clay & silty clay
5	clay & silty clay		
6	sandy silt & clayey silt		
7	silty sand & sandy silt	5	silty sand & sandy silt
8	sand & silty sand	6	sand & silty sand
9	sand		
10	sand	7	sand

11	very dense/stiff soil*	8	very dense/stiff soil*
12	very dense/stiff soil*	9	very dense/stiff soil*

*heavily overconsolidated and/or cemented

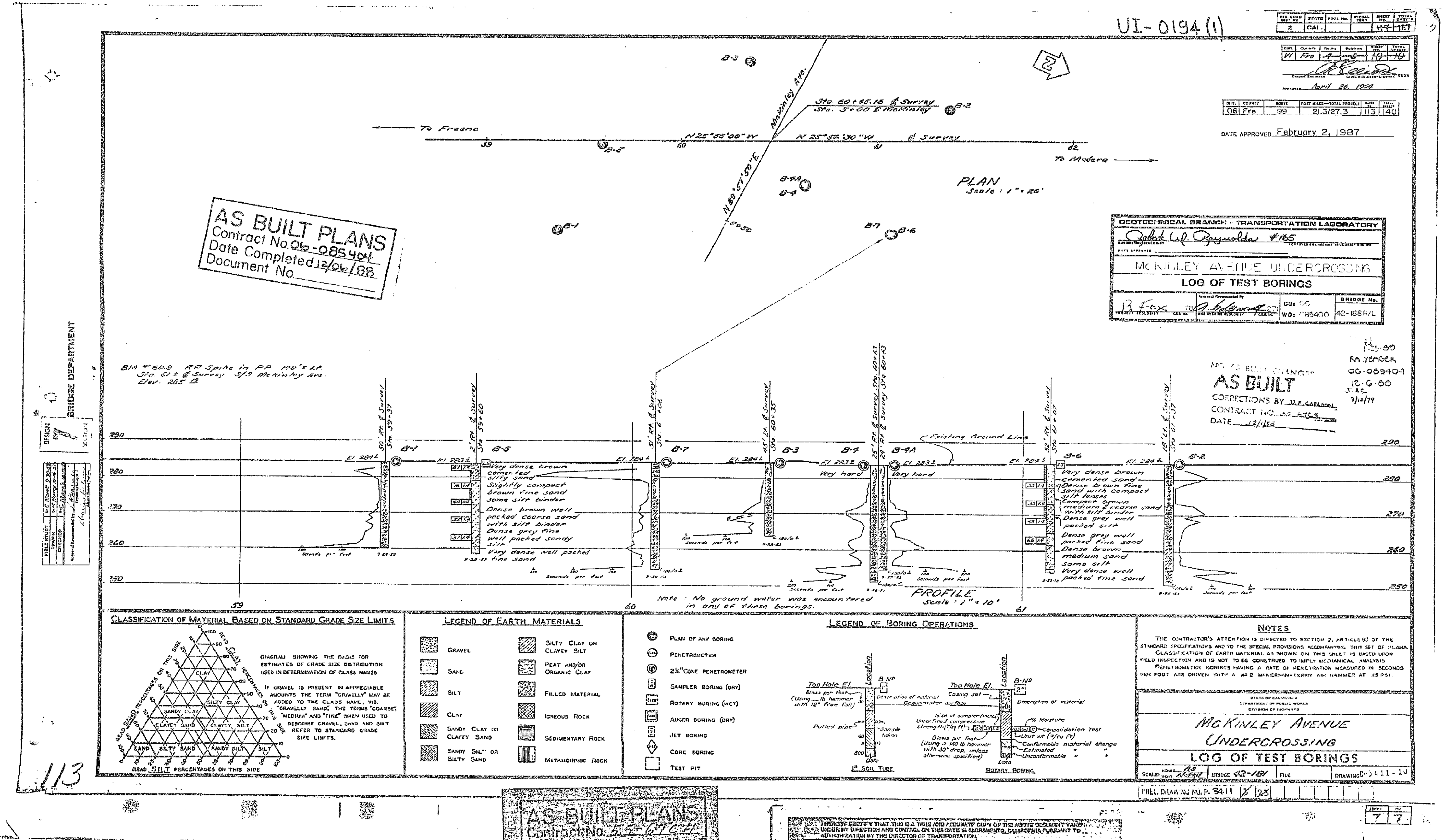
Track when soils fall with zones of same description and print that description (i.e. if soils fall only within SBT zones 4 & 5, print 'clays & silty clays')

Estimated Permeability (see Lunne et al., 1997)

SBT_n	Permeability (ft/sec)	(m/sec)
1	$3x\ 10^{-8}$	$1x\ 10^{-8}$
2	$3x\ 10^{-7}$	$1x\ 10^{-7}$
3	$1x\ 10^{-9}$	$3x\ 10^{-10}$
4	$3x\ 10^{-8}$	$1x\ 10^{-8}$
5	$3x\ 10^{-6}$	$1x\ 10^{-6}$
6	$3x\ 10^{-4}$	$1x\ 10^{-4}$
7	$3x\ 10^{-2}$	$1x\ 10^{-2}$
8	$3x\ 10^{-6}$	$1x\ 10^{-6}$
9	$1x\ 10^{-8}$	$3x\ 10^{-9}$

Estimated Unit Weight (see Lunne et al., 1997)

SBT	Approximate Unit Weight (lb/ft^3)	(kN/m^3)
1	111.4	17.5
2	79.6	12.5
3	111.4	17.5
4	114.6	18.0
5	114.6	18.0
6	114.6	18.0
7	117.8	18.5
8	120.9	19.0
9	124.1	19.5
10	127.3	20.0
11	130.5	20.5
12	120.9	19.0



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

2-14-89 SUPERVISOR OF MICROFILM SERVICES

MICROFILM · STATE OF CALIFORNIA · DEPARTMENT OF TRANSPORTATION · MICROFILM

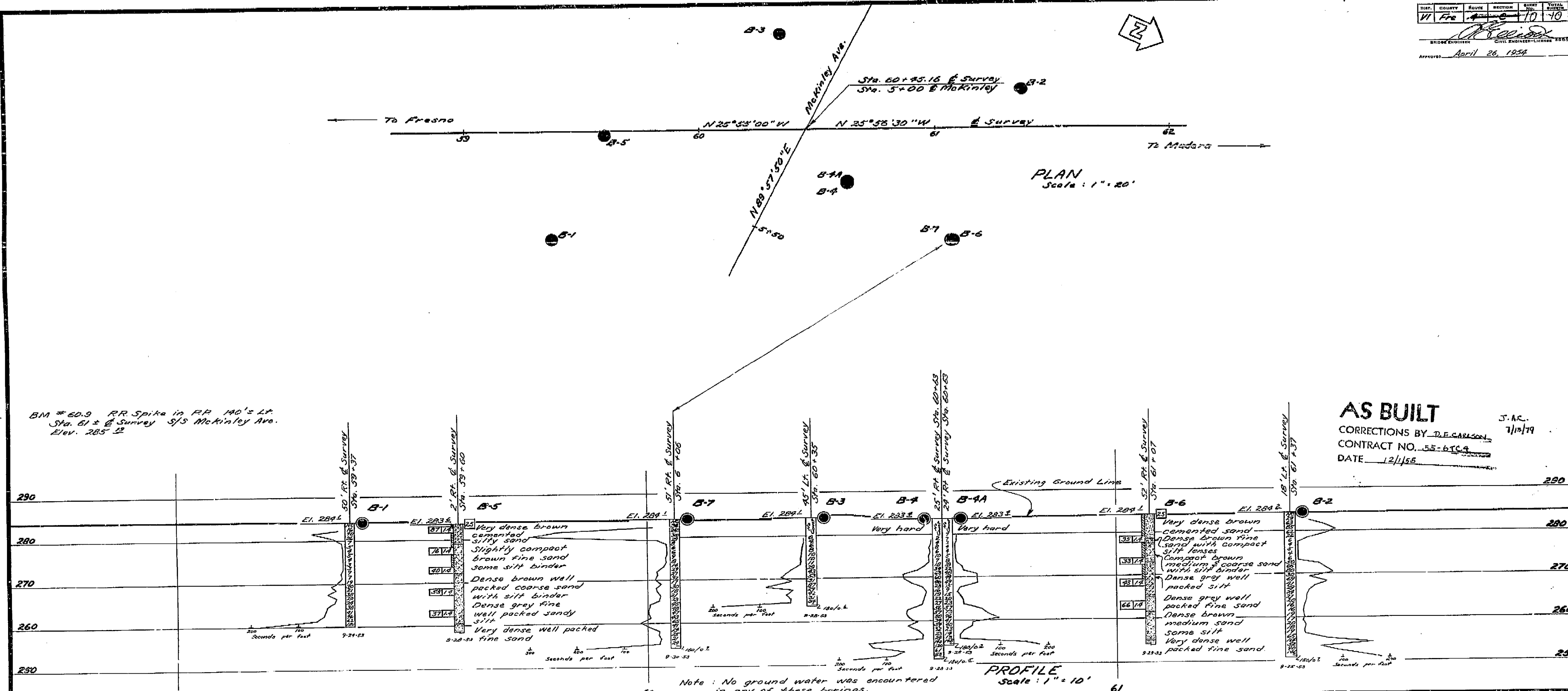
UI-0194 (1)

FED. ROAD DIST. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
2	CAL.			117	167

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
VI	Fre	4	C	10	10

BRIDGE ENGINEER — CIVIL ENGINEER—LICENSE 5565

APPROVED April 26, 1954



AS BUILT

CORRECTIONS BY D.F. CARLSON J.A.C. 7/13/79

CONTRACT NO. 55-6TC4

DATE 12/1/56

Classification of Material Based on Standard Grade Size Limits

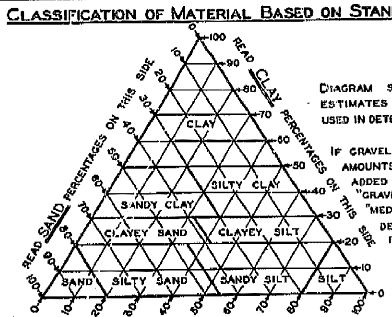


Diagram showing the basis for estimates of grade size distribution used in determination of class names

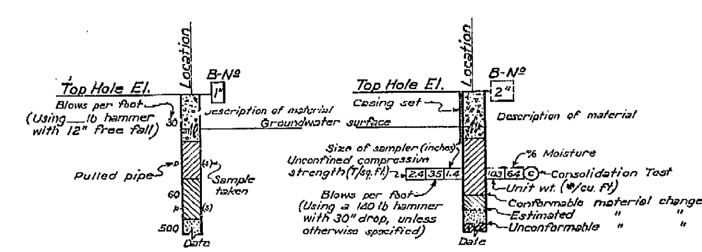
If gravel is present in appreciable amounts the term "gravelly" may be added to the class name, viz. "gravelly sand". The terms "coarse", "medium" and "fine" when used to describe gravel, sand and silt refer to standard grade size limits.

Legend of Earth Materials

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat and/or Organic Clay
- Filled Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

Legend of Boring Operations

- Plan of any boring
- Penetrometer
- 2½" Cone penetrometer
- Sampler boring (dry)
- Rotary boring (wet)
- Auger boring (dry)
- Jet boring
- Core boring
- Test pit



Notes

The contractor's attention is directed to Section 2, Article (c) of the Standard Specifications and to the Special Provisions accompanying this set of plans.

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

Penetrometer borings having a rate of penetration measured in seconds per foot are driven with a No. 2 McKiernan-Terry air hammer at 115 PSI.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

McKinley Avenue Undercrossing

LOG OF TEST BORINGS

SCALE: HORIZ. As VERT. Noted	BRIDGE 42-181	FILE	DRAWING C-3411-10

PREL. DRAWING NO. P-3411 3 23

FIELD STUDY — DRAWN — CHECKED — Approval Recommended by

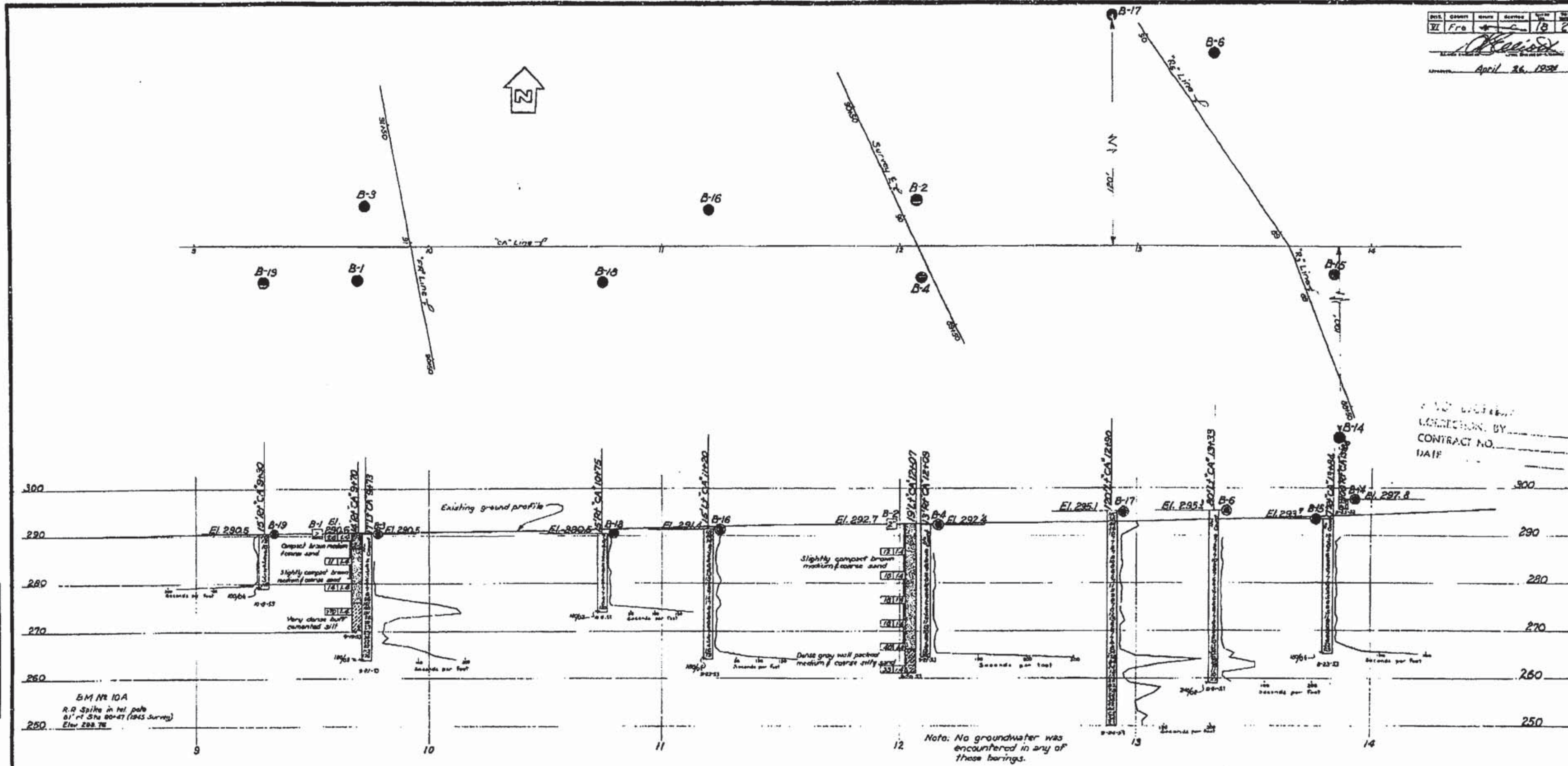
DESIGN 7 SECTION — BRIDGE DEPARTMENT

U-0194 (1)

DIST.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
2	CAL.			164	167

DIST.	COUNTY	ROUTE	SECTION		
VI	Fre	4	C	B	21

April 26, 1958



BRIDGE DEPARTMENT

AS BUILT CORRECTION BY
CONTRACT NO.
DATE

Classification of Material Based on Standard Grade Size Limits

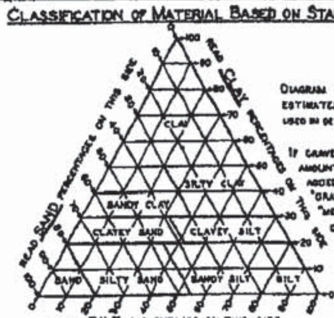


Diagram showing the basis for estimates of grade size distribution used in determination of class names

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- Metamorphic Rock

Legend of Boring Operations

- Plan of any boring
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- 2½" Cone penetrometer
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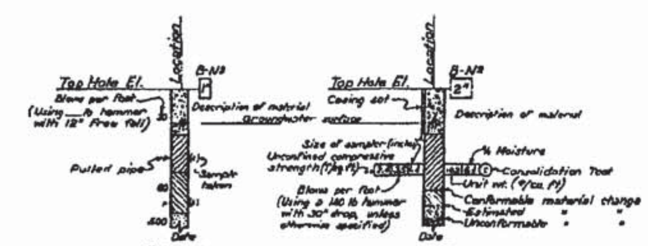
- Auger boring (dry)
- Jet boring
- Core boring
- Test pit



Notes

The contractor's attention is directed to Section 2, Article (c) of the Standard Specifications and to the special provisions accompanying this set of plans.

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

Penetrometer borings having a rate of penetration measured in seconds per foot are driven with a No 2 McKiernan-Terry air hammer at 110 psi.

State of California
Department of Public Works
Division of Highways

Clinton Avenue Overcrossing
&
~~Fresno Yard Overcrossing~~

LOG OF TEST BORINGS (1 of 2)

Scale	Bridge	File	Drawing
Horiz. 1" = 20', Vert. 1" = 10'	42-183, 42-191	E-42	E-3413-3

PREL. DRAWING NO. P-3413

AS BUILT PLANS
Contract No. 55-6TC4
Date Completed
Document No. 60000992

2	CAL.			35	

To Accompany Plans Dated 3-11-91

Dist.	County	Route	Section	Sheet No.	Total Sheets
				19	22

October 11, 19[illegible]

DIST.	COUNTY	ROUTE	POST MILES - TOTAL PROJECT	Sheet No.	Total Sheets
06	Fre	99	24.4, 26.6	143	199

ENGINEERING GEOLOGY BRANCH - TRANSPORTATION MATERIALS & RESEARCH

R.C. Wilhelms

CERTIFIED ENGINEERING GEOLOGIST

CLINTON AVE. O.C. (WIDEN)

LOG OF TEST BORINGS 4 OF 4

NOTE: THIS LOG OF TEST BORINGS IS AVAILABLE ON MICROFILM AT OFFICE OF STRUCTURES DESIGN SACRAMENTO, CALIFORNIA

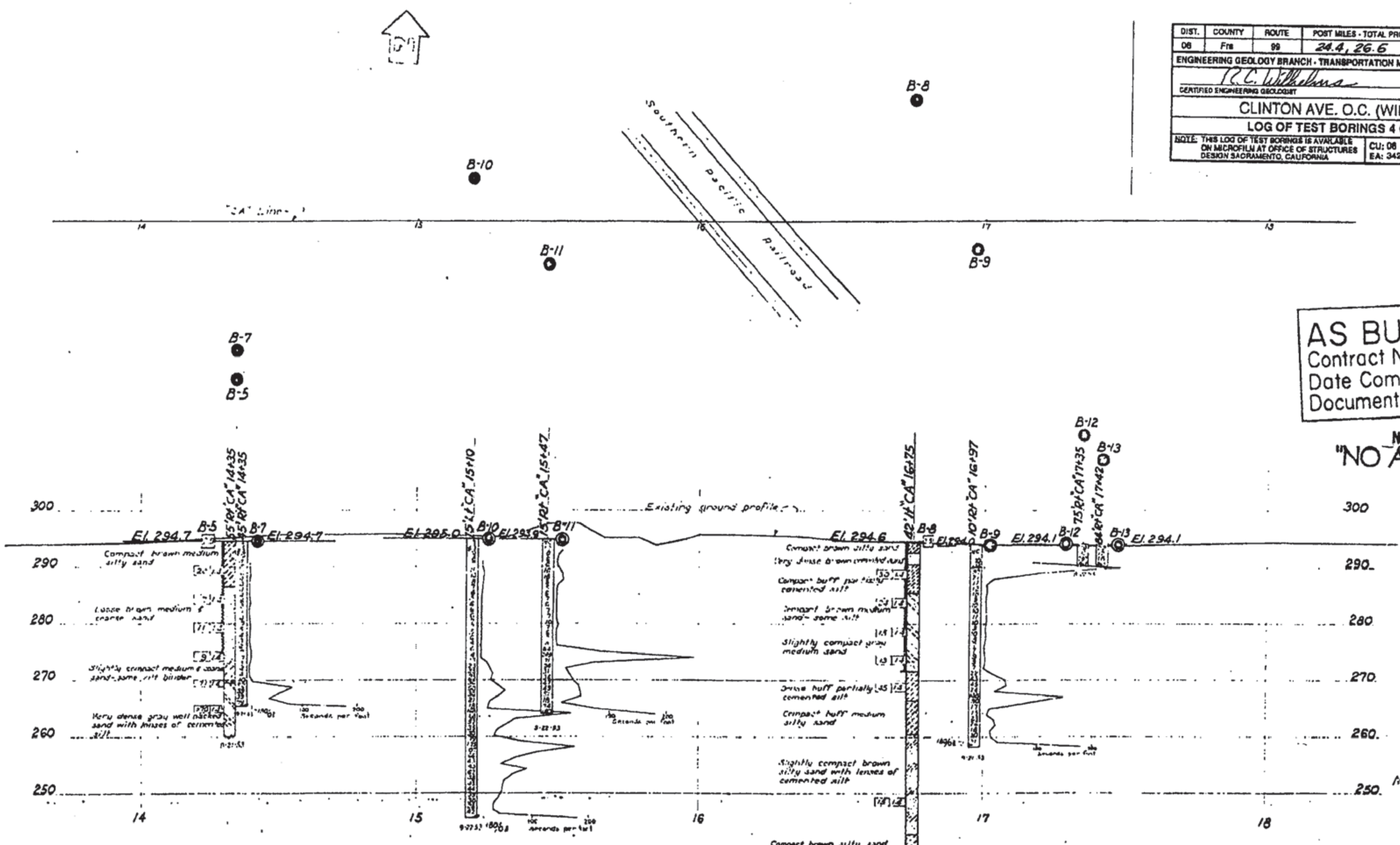
CU: 06
EA: 342931

BRIDGE No. 42-183

REGISTERED GEOLOGIST
R.C. WILHELMS
No. 660
Exp. 6-30-96
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

AS BUILT PLANS
Contract No. 55-14TC24
Date Completed
Document No. 60000991

~~NO ASBUILT CHANGES~~
"NO AS-BUILT CORRECTIONS"
AS BUILT
CORRECTIONS BY DAVID VALLEJOS
CONTRACT NO. 06-342934
DATE 4-16-93
VAH 6/6/94



Classification of Material Based on Standard Grade Size Limits

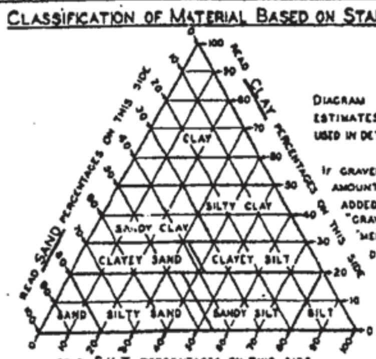


Diagram showing the basis for estimates of grade size distribution used in determination of class names

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- 2½" Cone penetrometer
- Sampler boring (dry)
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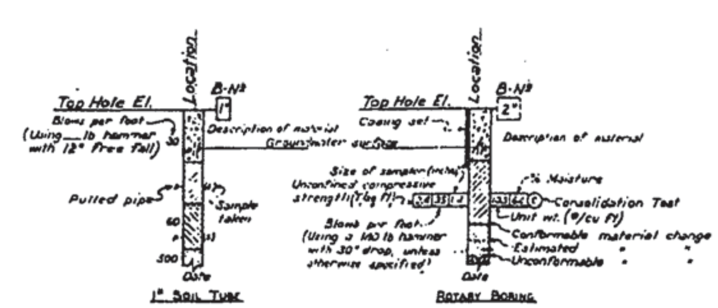
- Auger boring (dry)
- Jet boring
- Core boring
- Test pit



Notes

The contractor's attention is directed to Section 2, Article (c) of the Standard Specifications and to the Special Provisions accompanying this set of plans.

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

Penetrometer borings having a rate of penetration measured in seconds per foot are driven with a No 2 McKiernan-Terry air hammer at 115 PSI.

State of California
Department of Public Works
Division of Highways

CLINTON AVENUE OVERCROSSING & FRESNO YARD OVERCROSSING

LOG OF TEST BORINGS (2 of 2)

Scale	Bridge	File	Drawing
Horiz. 1" = 30' Vert. 1" = 10'	~~42-183~~ 42-191		

3413

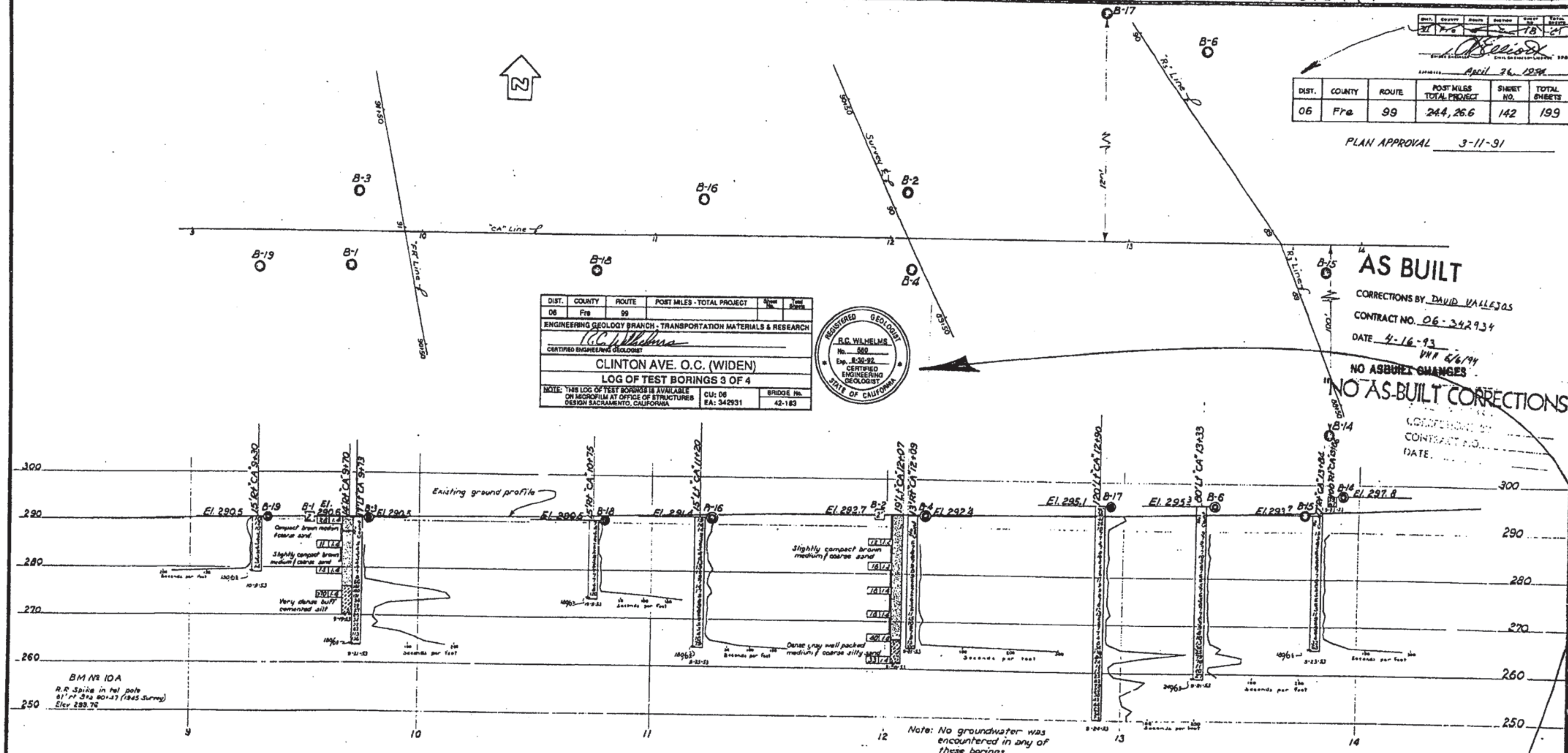
SHEET	OF
29	29

U-0194 (1)

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
06	Fre	99	24.4, 26.6	142	199

April 26, 1994

PLAN APPROVAL 3-11-91



DIST.	COUNTY	ROUTE	POST MILES - TOTAL PROJECT	Sheet No.	Total Sheets
06	Fre	99			

ENGINEERING GEOLOGY BRANCH - TRANSPORTATION MATERIALS & RESEARCH

R.C. Wilhelms

CERTIFIED ENGINEERING GEOLOGIST

CLINTON AVE. O.C. (WIDEN)

LOG OF TEST BORINGS 3 OF 4

NOTE: THIS LOG OF TEST BORINGS IS AVAILABLE ON MICROFILM AT OFFICE OF STRUCTURES DESIGN SACRAMENTO, CALIFORNIA | CU: 06 EA: 342931 | BRIDGE No. 42-183

REGISTERED GEOLOGIST R.C. WILHELMS No. 560 Exp. 6-30-92 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

AS BUILT

CORRECTIONS BY DAVID VALLEJOS

CONTRACT NO. 06-342934

DATE 4-16-93

VHR 6/6/94

NO ~~ASBUILT~~ CHANGES

"NO AS-BUILT CORRECTIONS"

CORRECTIONS BY

CONTRACT NO.

DATE

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

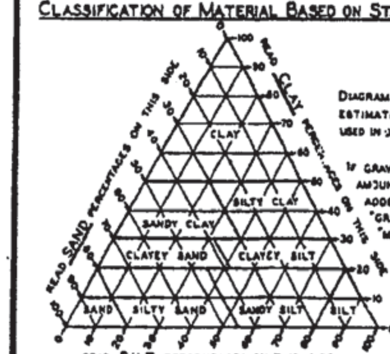


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES

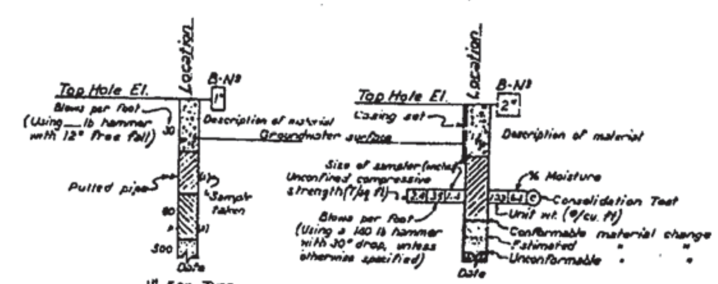
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND". THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE GRAVEL, SAND AND SILT REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND/OR ORGANIC CLAY
- FILLED MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- 2½" CONE PENETROMETER
- SAMPLER BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT



NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (f) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET OF PLANS.

CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.

PENETROMETER BORINGS HAVING A RATE OF PENETRATION MEASURED IN SECONDS PER FOOT ARE DRIVEN WITH A No 2 McKIERNAN-TERRY AIR HAMMER AT 115 PSI.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

CLINTON AVENUE & OVERCROSSING

~~FRESNO YARD OVERCROSSING~~

LOG OF TEST BORINGS ~~(1 of 2)~~

SCALE: HORIZ. 1" = 20' VERT. 1" = 10' | BRIDGE 42-183 42-191 | FILE E-42 | DRAWING C-3413-1

PREL. DRAWING NO. P-3413 | SHEET 28 OF 29

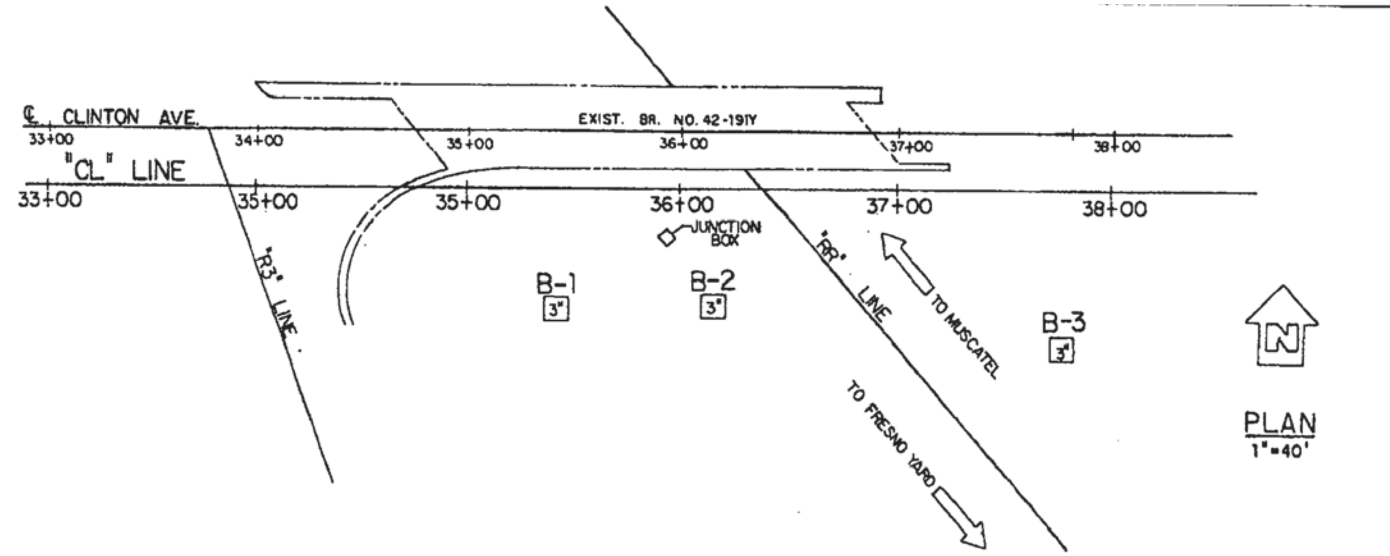
AS BUILT PLANS

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
06	Fre	99	24.4, 26.6	141	199

R.C. Wilhelms
CERTIFIED ENGINEERING GEOLOGIST

3-11-91
PLANS APPROVAL DATE

REGISTERED GEOLOGIST
Exp. 6-30-92
R.C. WILHELMS
No. 560
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA



NO ASBUILT CHANGES

"NO AS-BUILT CORRECTIONS"

AS BUILT

CORRECTIONS BY DAVID VALLEJOS

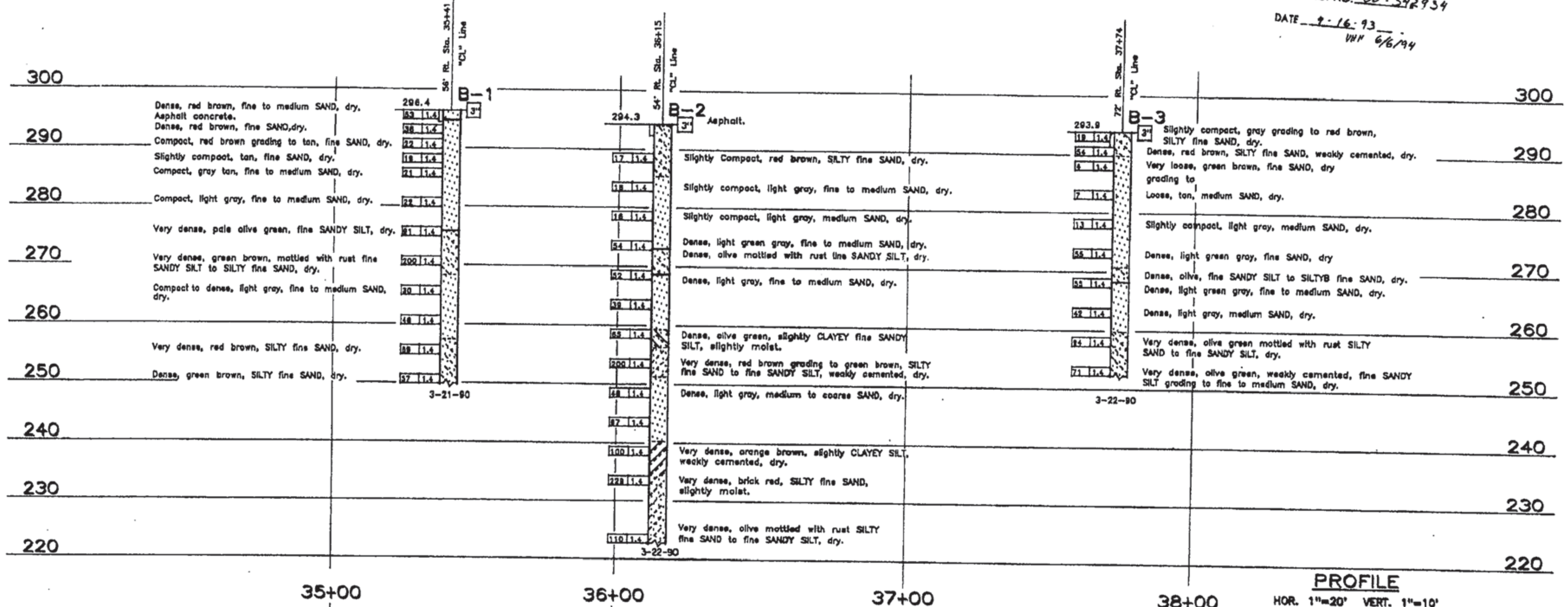
CONTRACT NO. 06-342934

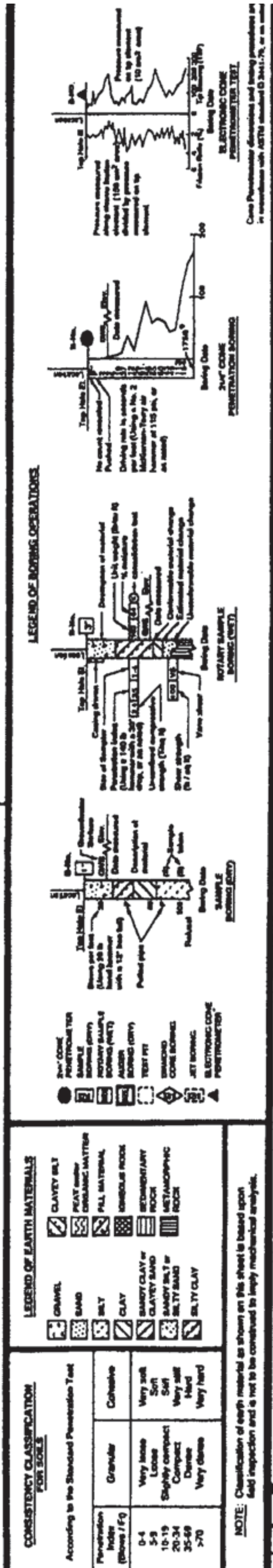
DATE 9-16-93

VHH 6/6/94

BENCH MARK

FD. USC & GS BM C-368, 1953 SE CORNER CONCRETE JCT. BOX. ELEVATION 298.96





NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

ENGINEERING GEOLOGY BRANCH - TRANSPORTATION LABORATORY

DRAWN BY	LEONY L. LOPEZ	4/90
CHECKED BY		

John Fujimoto, PROJECT ENGINEER

State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 42-183
POST MILE 24.4

CLINTON AVE. O.C. (WIDEN)
LOG OF TEST BORINGS 2 OF 4

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06
EA 342931

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 27 OF 29

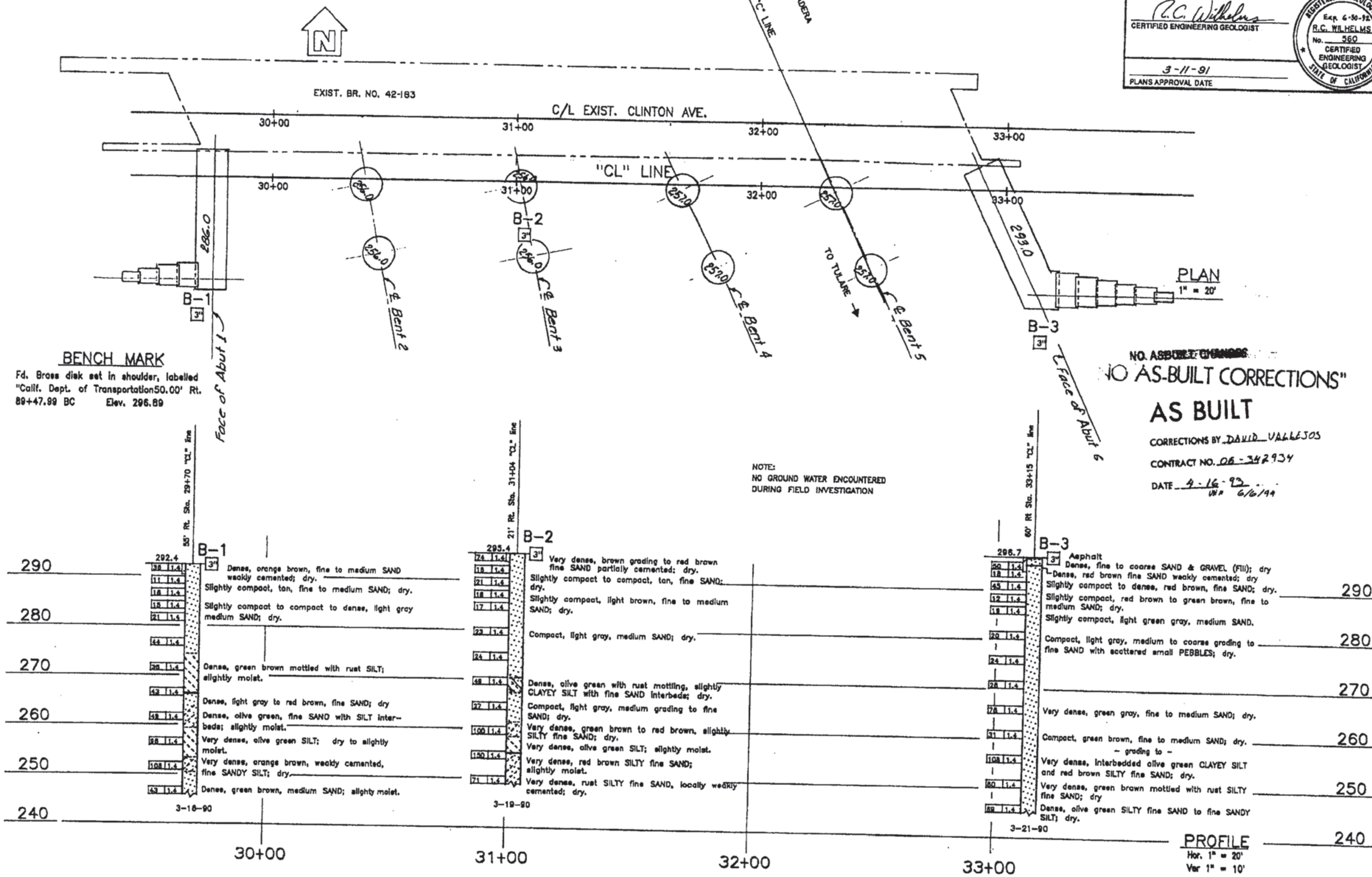
TL-0951 REV. 4/86

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
06	Fre	99	24.4, 26.6	140	199

R.C. Wilhelms
CERTIFIED ENGINEERING GEOLOGIST

3-11-91
PLANS APPROVAL DATE

REGISTERED GEOLOGIST · Exp. 6-30-92 · R.C. WILHELMS · No. 560 · CERTIFIED ENGINEERING GEOLOGIST · STATE OF CALIFORNIA



NO AS-BUILT CHANGES
"NO AS-BUILT CORRECTIONS"
AS BUILT
CORRECTIONS BY DAVID VALLEJOS
CONTRACT NO. 06-342934
DATE 4-16-93
UNR 6/6/94

LEGEND OF BORING OPERATIONS

LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION FOR SOILS — According to the Standard Penetration Test

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

ENGINEERING GEOLOGY BRANCH - TRANSPORTATION LABORATORY

DRAWN BY IRMA GAMARRA 5/90

CHECKED BY

John Fujimoto, PROJECT ENGINEER

State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 2

BRIDGE NO. 42-183
POST MILE 24.4

CLINTON AVE. O.C. (WIDEN)
LOG OF TEST BORINGS 1 OF 4

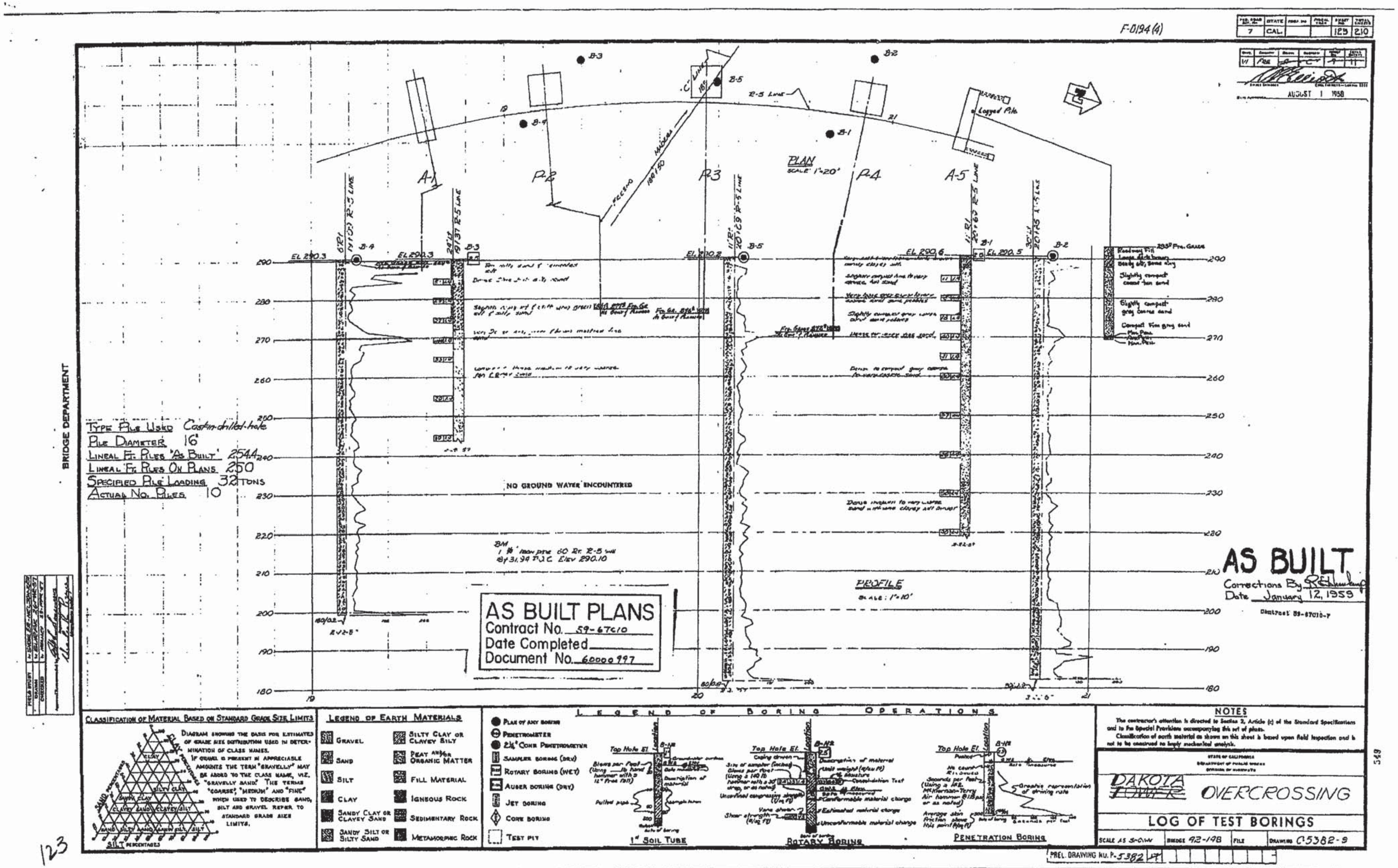
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06
EA 342931

DISREGARD PRINTS BEARING EARLIER REVISION DATES

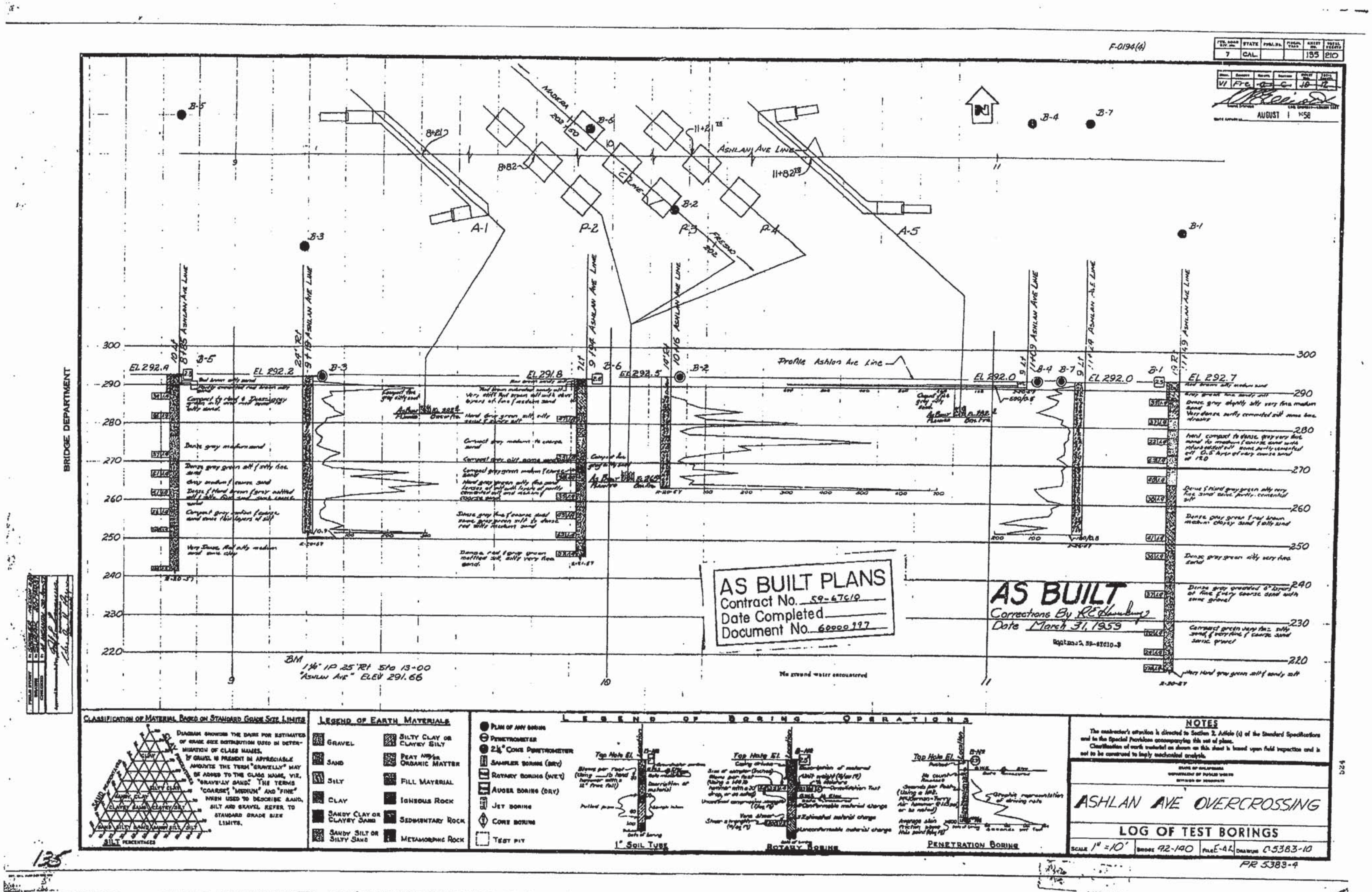
REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 26 OF 29



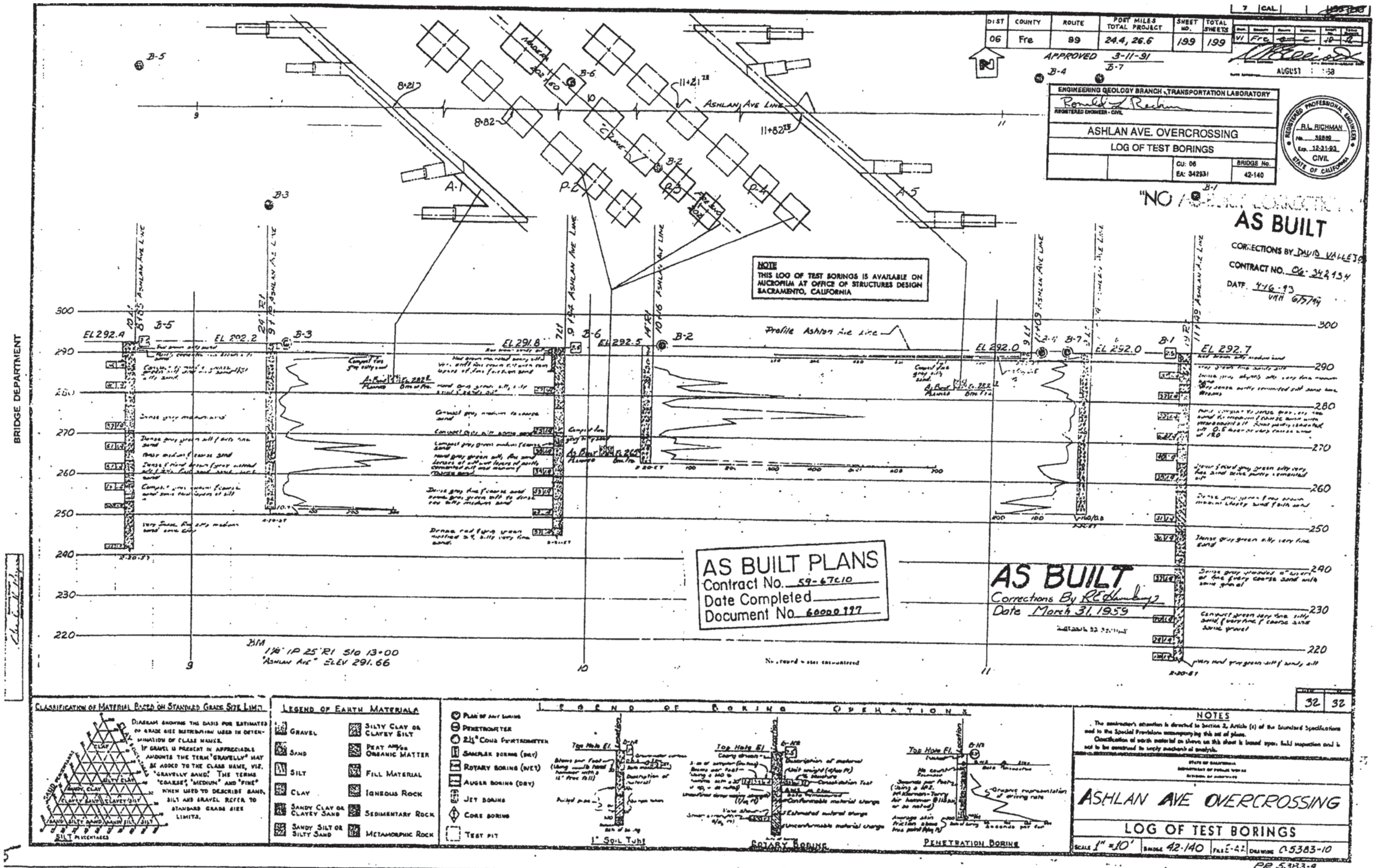
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 9/16/71 SIGNATURE [signature] TITLE HAC II

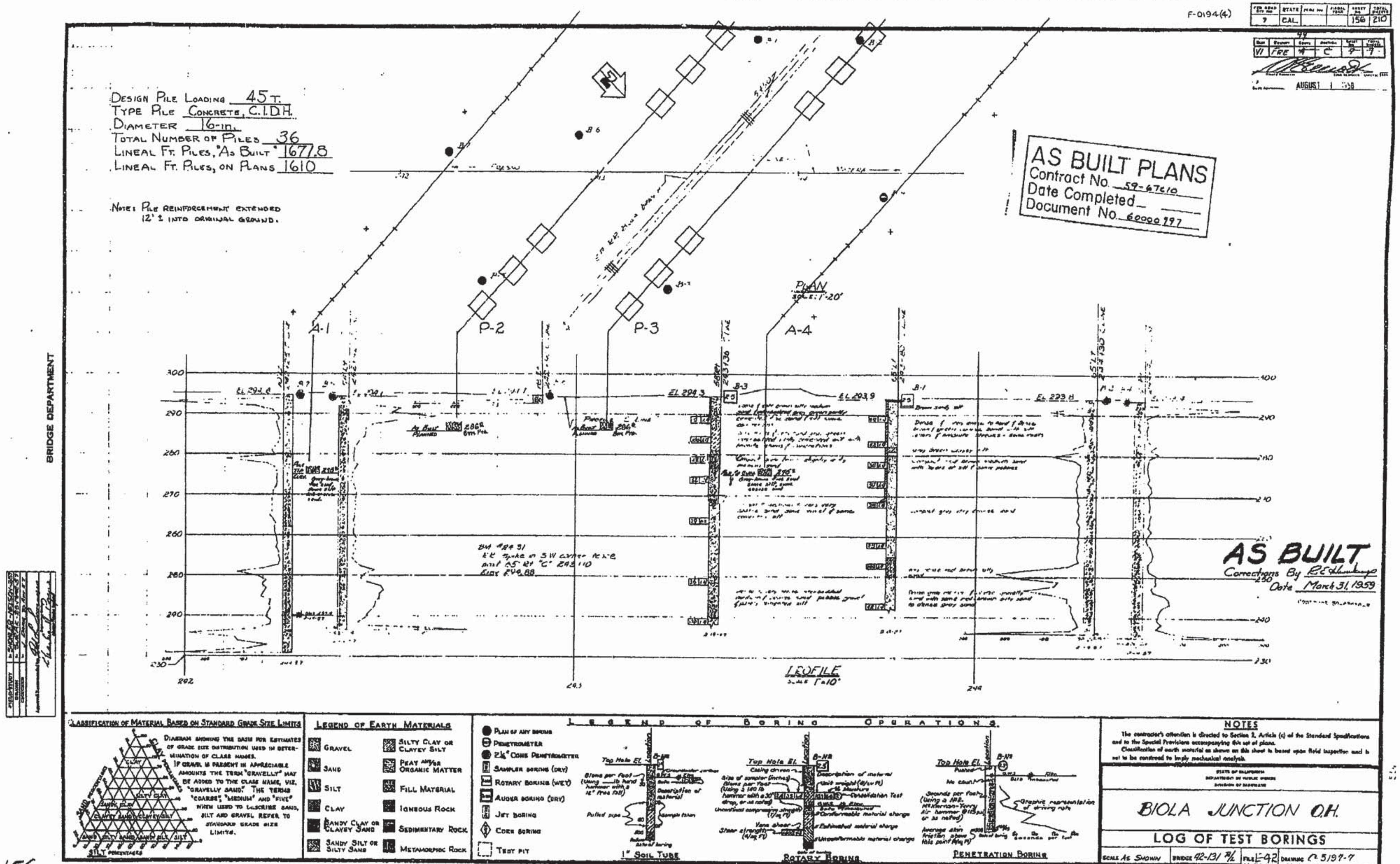


I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 9/16/91 SIGNATURE [signature] TITLE HAC II



ClibPDF - www.fastio.com

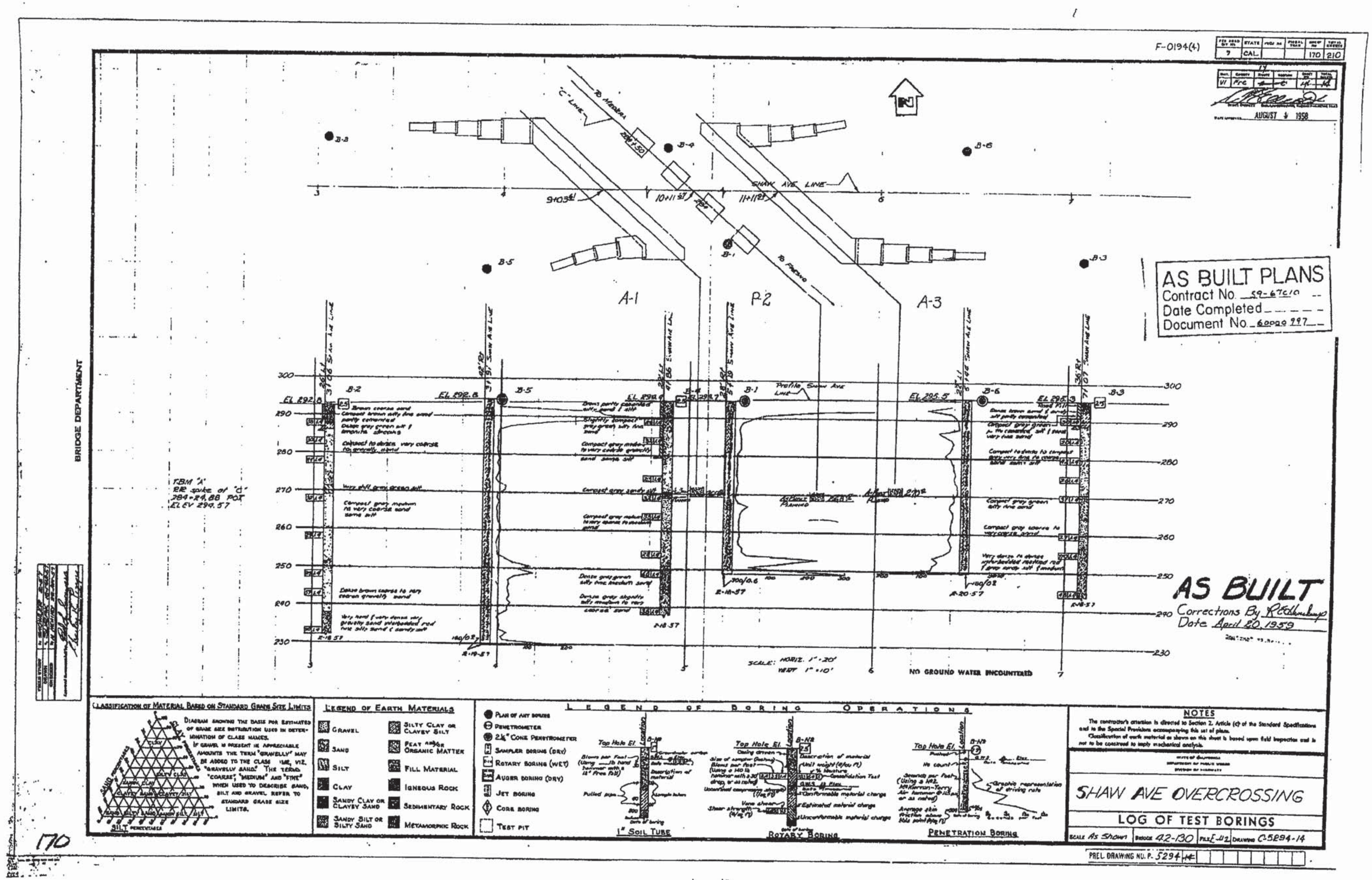


156

PREL. DRAWING No. P 5197 +0 PR-5197-3

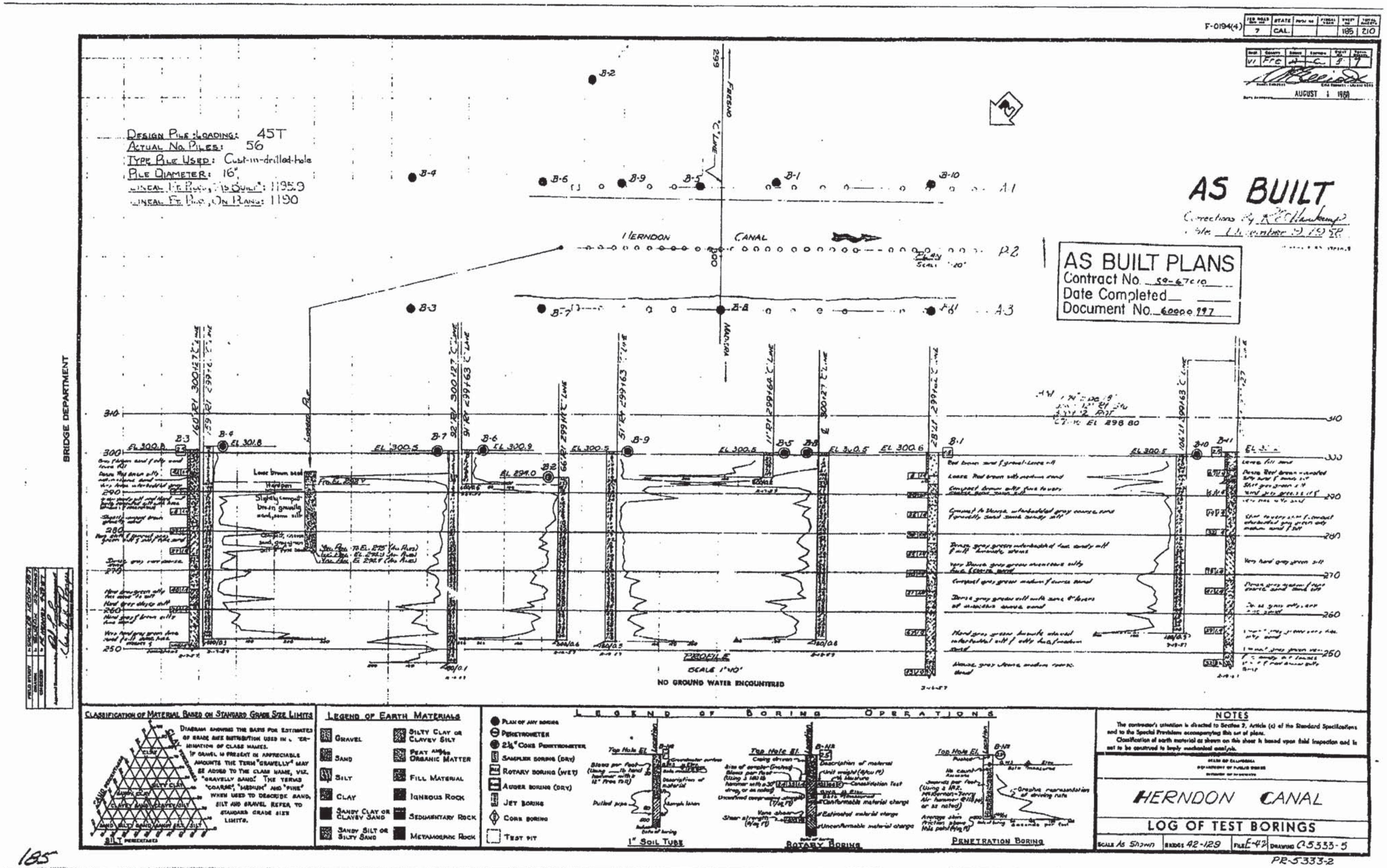
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE ______ SIGNATURE ______ TITLE ______



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE ______ SIGNATURE ______ TITLE ______

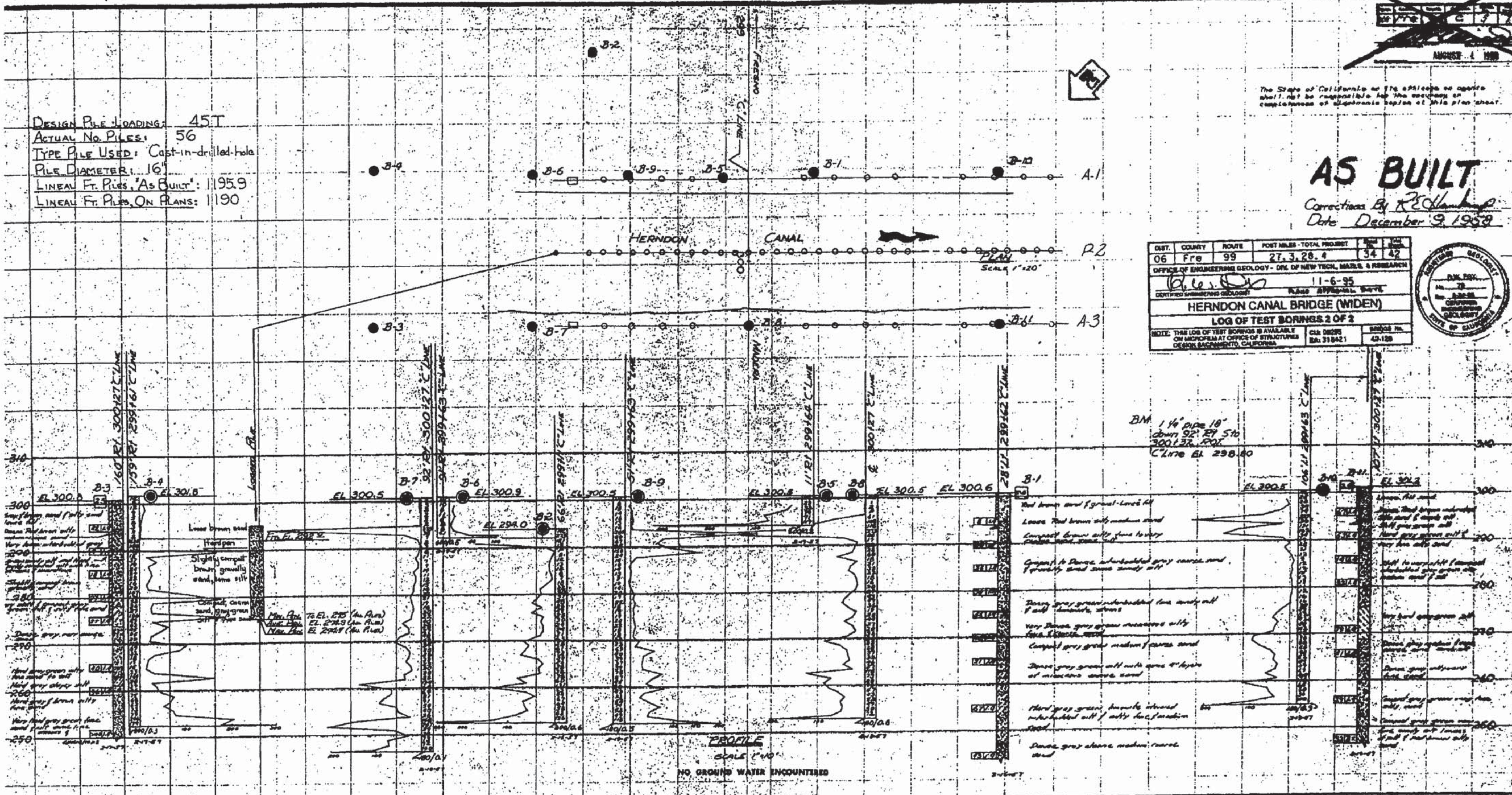


185

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 9/14/71 SIGNATURE [illegible] TITLE [illegible]

Design Pile Loading: 45T
Actual No. Piles: 56
Type Pile Used: Cast-in-drilled-hole
Pile Diameter: 16"
Lineal Ft. Piles, "As Built": 1195.9
Lineal Ft. Piles, On Plans: 1190



AS BUILT
Corrections By R.E. [signature]
Date December 9, 1958

DIST.	COUNTY	ROUTE	POST MILES - TOTAL PROJECT		
06	Fre	99	27.3, 28.4	34	42

OFFICE OF ENGINEERING GEOLOGY - DIV. OF NEW TECH, MATLS. & RESEARCH
11-6-95
CERTIFIED ENGINEERING GEOLOGIST
HERNDON CANAL BRIDGE (WIDEN)
LOG OF TEST BORINGS 2 OF 2
NOTE: THIS LOG OF TEST BORINGS IS AVAILABLE ON MICROFILM AT OFFICE OF STRUCTURES DESIGN, SACRAMENTO, CALIFORNIA
CU: 06295
EA: 318421
BRIDGE No. 42-129

Classification of Material Based on Standard Grade Size Limits

Diagram showing the basis for estimates of grade size distribution used in determination of class names.
If gravel is present in appreciable amounts the term "gravelly" may be added to the class name, viz. "gravelly sand". The terms "coarse", "medium" and "fine" when used to describe sand, silt and gravel refer to standard grade size limits.

Legend of Earth Materials

Gravel
Sand
Silt
Clay
Sandy Clay or Clayey Sand
Sandy Silt or Silty Sand
Silty Clay or Clayey Silt
Peat and/or Organic Matter
Fill Material
Igneous Rock
Sedimentary Rock
Metamorphic Rock

Legend of Boring Operations

Plan of any boring
Penetrometer
2 1/2" Cone Penetrometer
Sampler boring (dry)
Rotary boring (wet)
Auger boring (dry)
Jet boring
Core boring
Test pit

1" Soil Tube
Rotary Boring
Penetration Boring

NOTES

The contractor's attention is directed to Section 2, Article (c) of the Standard Specifications and to the Special Provisions accompanying this set of plans.
Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

HERNDON CANAL
LOG OF TEST BORINGS NO. 2
Scale As Shown | Bridge 42-129 | File E-42 | Drawing C-5333-5

SHEET	OF
14	14

PR-5333-2

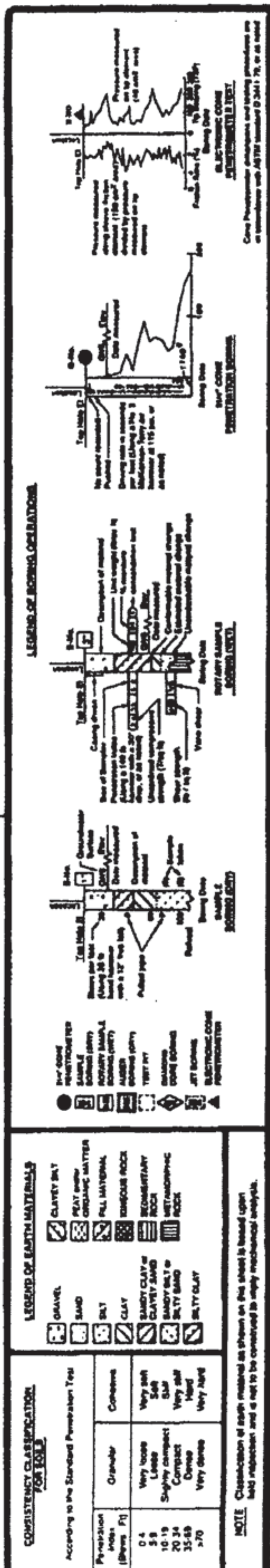
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
06	Fre	99	27.3,28.4	33	42

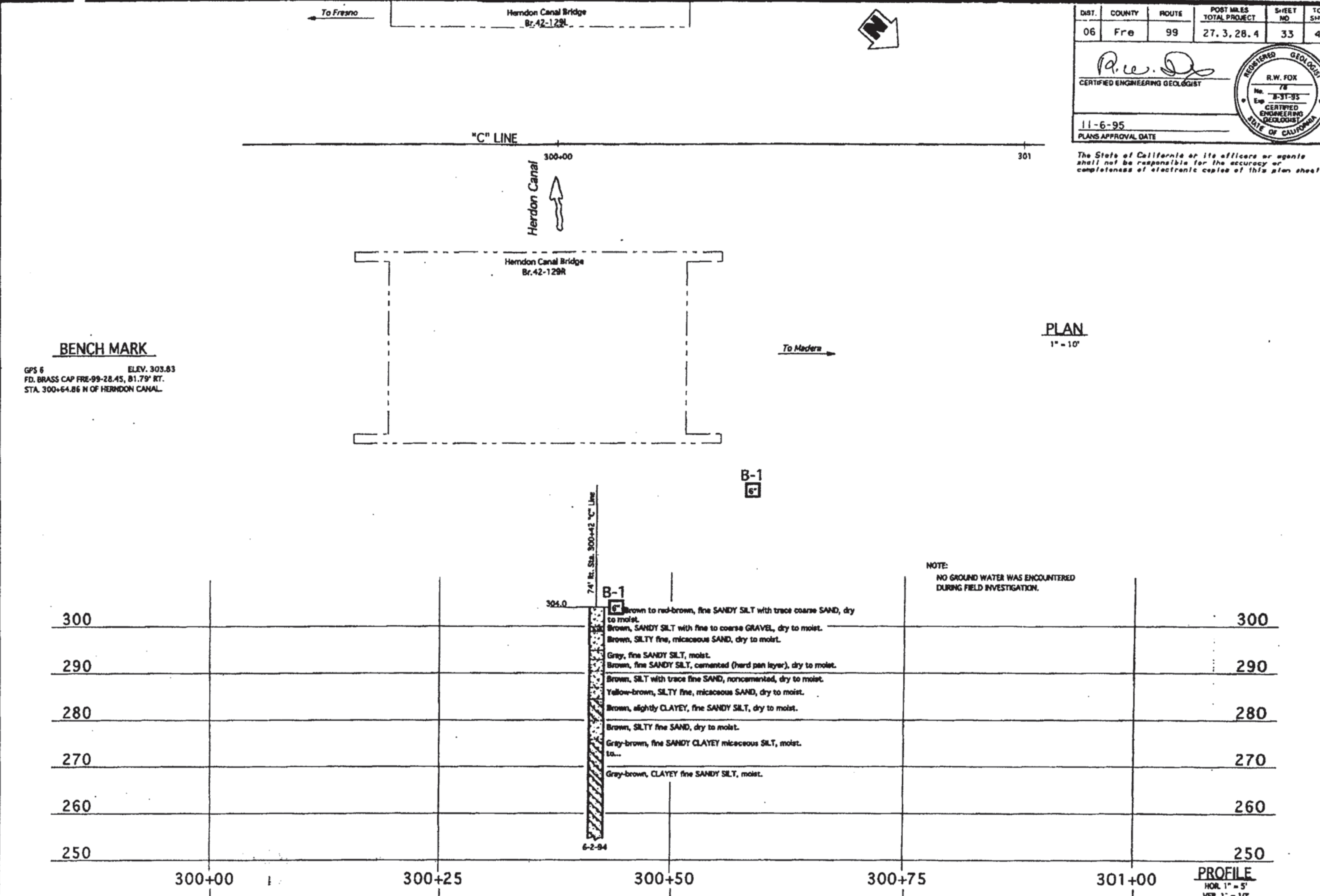
CERTIFIED ENGINEERING GEOLOGIST

11-6-95
PLANS APPROVAL DATE

REGISTERED GEOLOGIST R.W. FOX No. 78 Exp. 8-31-95 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.





DIVISION OF NEW TECHNOLOGY, MATERIALS AND RESEARCH	OFFICE OF ENGINEERING GEOLOGY	FIELD INVESTIGATION BY:	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 42-129R	HERNDON CANAL BRIDGE (WIDEN)
DRAWN BY	7/94	J. THORNE			POST MILE 28.4	LOG OF TEST BORINGS NO. 1
CHECKED BY						

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06255
EA 318421

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 13 OF 14

APPENDIX B

- Laboratory Test Data

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classifications of the samples were visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on “Log of Test Borings”, Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the “Log of Test Borings”, Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate No: B-2, “Plasticity Chart”.

Grain Size Classification

Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plate No: B-3A through Plate No: B-3K, “Grain Size Distribution Curves”.

Unconsolidated- Undrained Traxial Compression Tests

Unconsolidated- Undrained Traxial Compression test was performed on selected undisturbed sample. Test was performed in general accordance with ASTM Test Method D 2850-95. The result is presented on Plate No: B-4A.

Corrosion Test

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The tests were performed by Sunland Analytical. The test results are presented on Plate No: B-5A through Plate No: B-5I.

Direct Shear Tests

Direct Shear tests were performed on selected relatively undisturbed samples to determine the shear strength of a soil material in direct shear. The tests were performed according to ASTM Test Method D 3080 by Cooper. The test result is presented on Plate No: B-6A through Plate No: B-6O.

APPENDIX B

LABORATORY TESTS
(Continued)

Collapse Potential of Soil Tests

Collapse Potential of Soil tests (ASTM Test Method D 5333) were performed on selected samples to aid in the classification. The results are presented on Plate No: B-7A through Plate No: B-7B.

Expansion Index Tests

Expansion Index tests (ASTM Test Method D 4829) were performed on selected samples. The results are presented on Plate No: B-8A and Plate No: B-8B.

R-value Tests

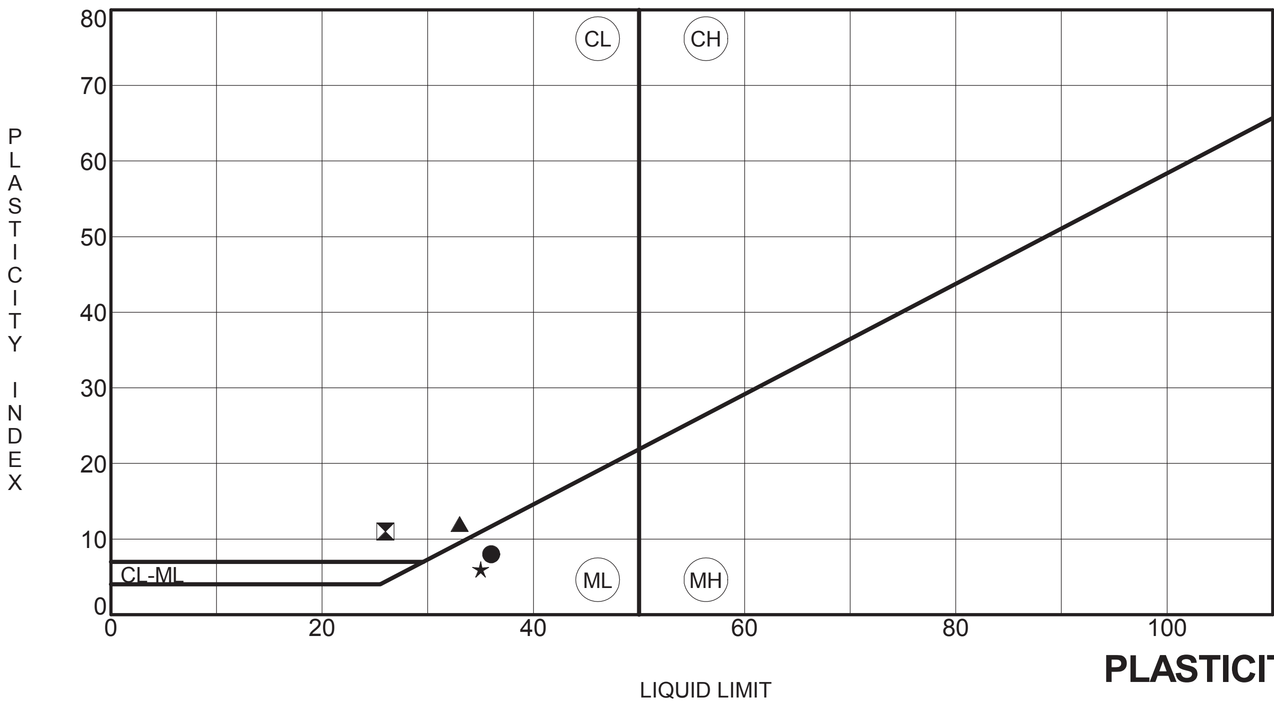
R-value tests were performed on selected bulk samples. The tests were performed according to California Test Method 301. The test results are presented on Plate No: B-9A through Plate No: B-9F.

Laboratory Compaction Tests

Laboratory Compaction tests were performed on selected bulk samples. The tests were performed according to California Test Method D 1557. The test results are presented on Plate No: B-10A through Plate No: B-10I.

California Bearing Ratio Tests

California Bearing Ratio Tests were performed on selected bulk samples. The tests were performed according to ASTM Test Method D1883. The test results are presented on Plate No: B-11A and Plate No: B-11B.



PLASTICITY

	BOREHOLE	SAMPLE #	DEPTH (ft)	LL	PL	PI	Fines	USCS Classification
●	**S0001A**	**S12**	**56.0**	**36**	**28**	**8**		**SILT**
⧗	**S0005A**	**S02**	**6.0**	**26**	**15**	**11**		**Lean CLAY**
▲	**S0006A**	**S05**	**21.0**	**33**	**21**	**12**		**Lean CLAY**
★	**S0008A**	**S03**	**11.0**	**35**	**29**	**6**		**SILT**

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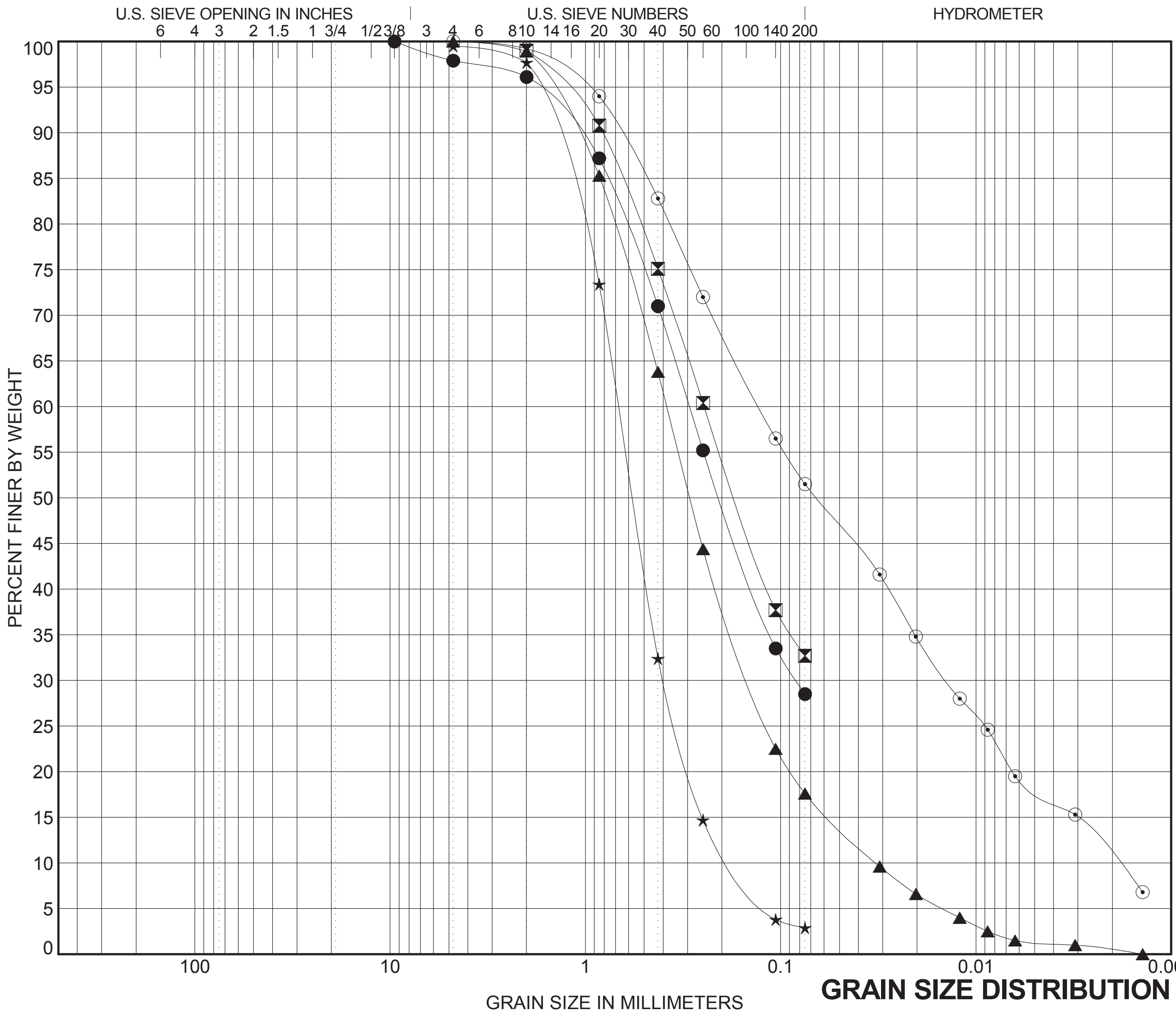
MATERIALS ENGINEERING

Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO:2009-138-400 | **PLATE NO:** B-2



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	**S0001A**	**S01**	**3.0**	**CLAYEY SAND**					
⧗	**S0001A**	**BULK**	**4.0**	**SILTY SAND**					
▲	**S0001A**	**S03**	**11.0**	**SILTY SAND**				**1.62**	**11.79**
★	**S0001A**	**S05**	**21.0**	**Poorly graded SAND**				**1.34**	**3.92**
⊙	**S0001A**	**S09**	**41.0**	**SANDY SILT**				**0.82**	**68.13**

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**S0001A**	**S01**	**3.0**	**9.5**	**0.294**	**0.083**		**2.1**	**69.4**	**28.5**	
⧗	**S0001A**	**BULK**	**4.0**	**2**	**0.246**				**66.3**	**32.7**	
▲	**S0001A**	**S03**	**11.0**	**4.75**	**0.383**	**0.142**	**0.032**	**0.0**	**82.4**	**16.3**	**1.3**
★	**S0001A**	**S05**	**21.0**	**4.75**	**0.678**	**0.395**	**0.173**		**96.6**	**2.9**	
⊙	**S0001A**	**S09**	**41.0**	**4.75**	**0.129**	**0.014**	**0.002**	**0.0**	**48.5**	**33.4**	**18.1**

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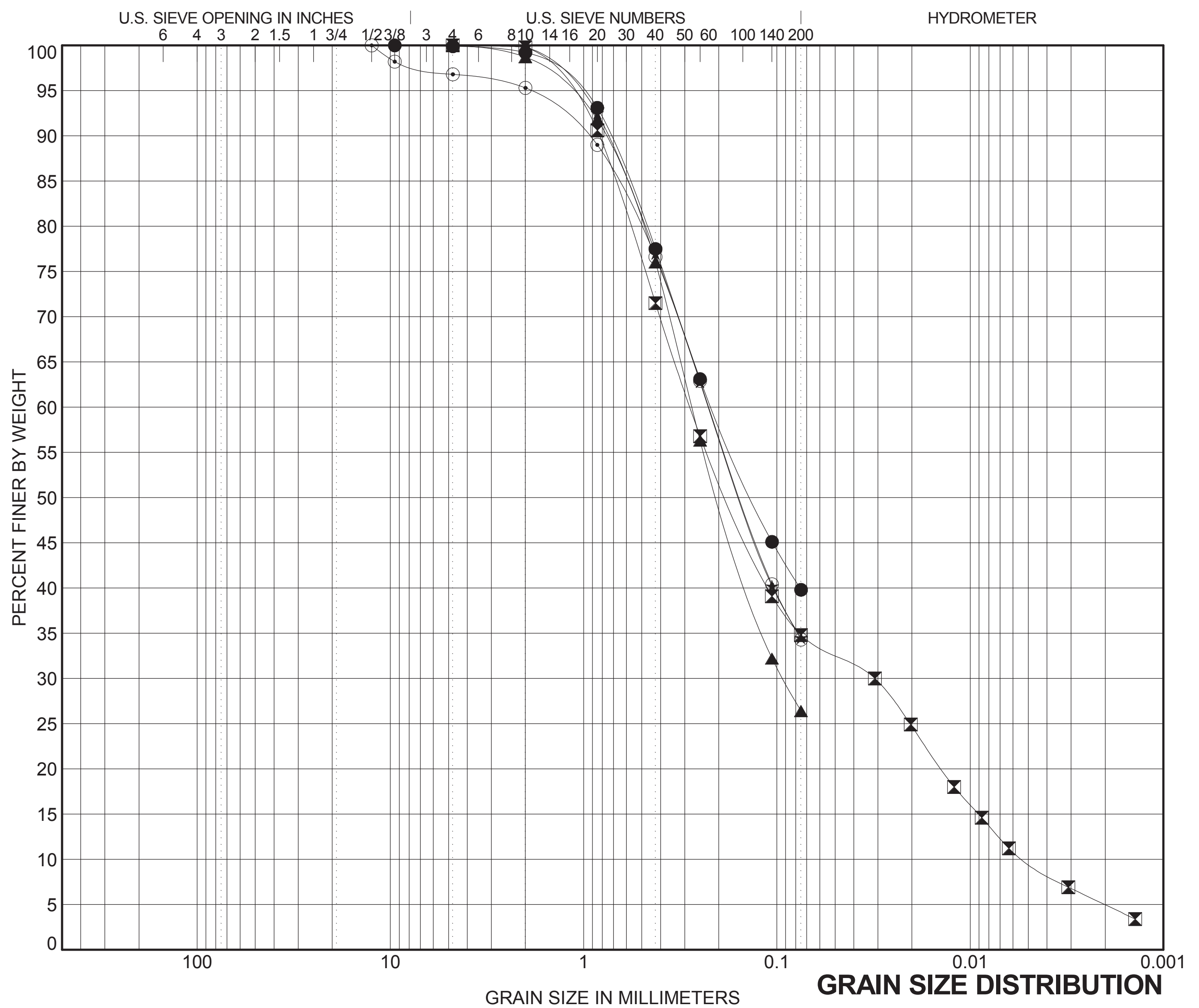
JOB NO: 2009-138-400 | **PLATE NO:** B-3A



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	S0001A	S13	61.0	CLAYEY SAND					
⧗	S0001A	S18	86.0	SILTY SAND				0.67	54.29
▲	S0001A	S21	101.0	SILTY SAND					
★	S0002A	S01	3.0	SILTY SAND					
⊙	S0002A	BULK	4.0	SILTY SAND					

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	S0001A	S13	61.0	9.5	0.216			0.1	60.1	39.8	
⧗	S0001A	S18	86.0	4.75	0.281	0.031	0.005	0.0	65.2	25.0	9.8
▲	S0001A	S21	101.0	4.75	0.276	0.093		0.0	73.6	26.4	
★	S0002A	S01	3.0	4.75	0.225			0.0	65.5	34.5	
⊙	S0002A	BULK	4.0	12.5	0.224			3.2	62.5	34.3	

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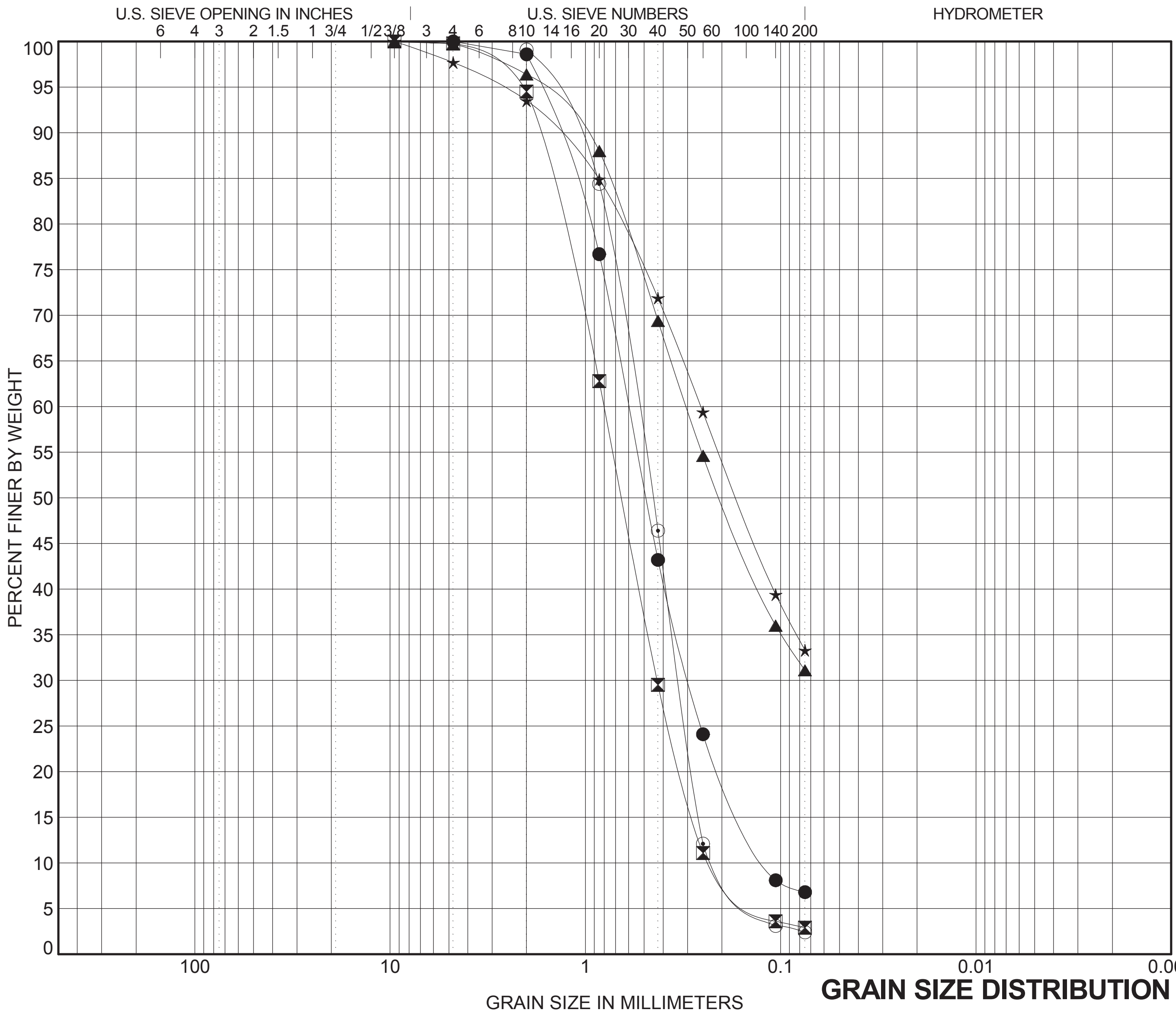
JOB NO: 2009-138-400

PLATE NO: B-3B



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	**S0002A**	**S04**	**16.0**	**Poorly graded SAND with SILT**				**1.23**	**5.13**
⧗	**S0002A**	**S06**	**26.0**	**Poorly graded SAND**				**1.04**	**3.64**
▲	**S0003A**	**S01**	**3.0**	**SILTY SAND**					
★	**S0003A**	**BULK**	**4.0**	**SILTY SAND**					
⊙	**S0003A**	**S04**	**16.0**	**Poorly graded SAND**				**0.98**	**2.66**

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**S0002A**	**S04**	**16.0**	**4.75**	**0.602**	**0.295**	**0.117**	**0.0**	**93.2**	**6.8**	
⧗	**S0002A**	**S06**	**26.0**	**9.5**	**0.802**	**0.429**	**0.22**	**0.2**	**96.9**	**2.9**	
▲	**S0003A**	**S01**	**3.0**	**9.5**	**0.303**			**0.3**	**68.6**	**31.1**	
★	**S0003A**	**BULK**	**4.0**	**9.5**	**0.256**			**2.3**	**64.4**	**33.3**	
⊙	**S0003A**	**S04**	**16.0**	**2**	**0.545**	**0.33**	**0.205**		**96.7**	**2.4**	

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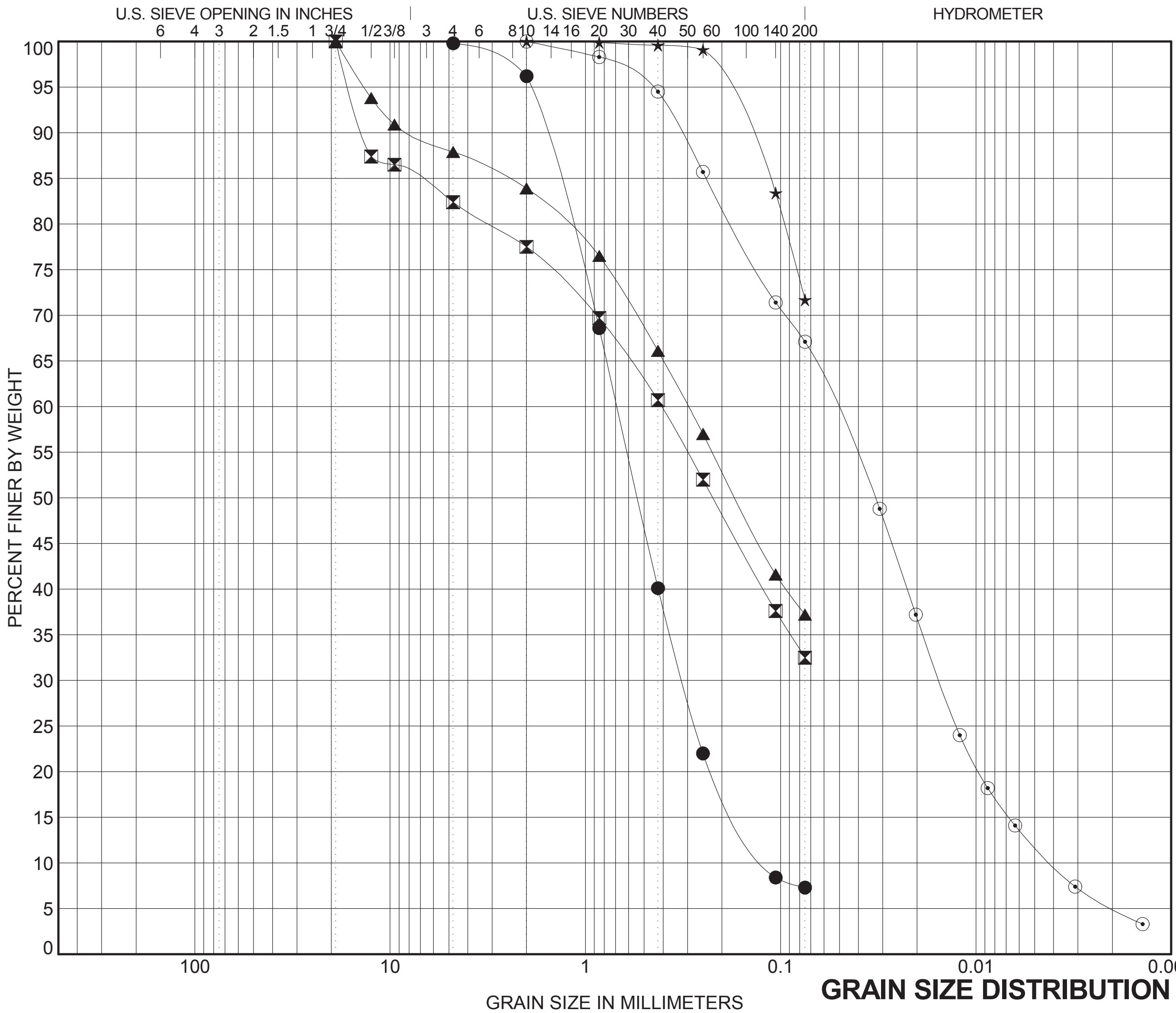
Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO:2009-138-400 | **PLATE NO:** B-3C



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	**S0003A**	**S06**	**26.0**	**Poorly graded SAND with SILT**				**1.24**	**5.88**
⧗	**S0005A**	**S01**	**3.0**	**SILTY SAND with GRAVEL**					
▲	**S0005A**	**BULK**	**4.0**	**SILTY SAND with GRAVEL**					
★	**S0005A**	**S03**	**11.0**	**SILT with SAND**					
⊙	**S0005A**	**S06**	**26.0**	**SANDY SILT**				**1.08**	**13.06**

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**S0003A**	**S06**	**26.0**	**4.75**	**0.69**	**0.316**	**0.117**		**92.5**	**7.3**	
⧗	**S0005A**	**S01**	**3.0**	**19**	**0.407**			**17.6**	**49.9**	**32.5**	
▲	**S0005A**	**BULK**	**4.0**	**19**	**0.298**			**12.1**	**50.7**	**37.2**	
★	**S0005A**	**S03**	**11.0**	**2**				**0.0**	**28.3**	**71.7**	
⊙	**S0005A**	**S06**	**26.0**	**2**	**0.053**	**0.015**	**0.004**	**0.0**	**32.9**	**55.2**	**11.9**

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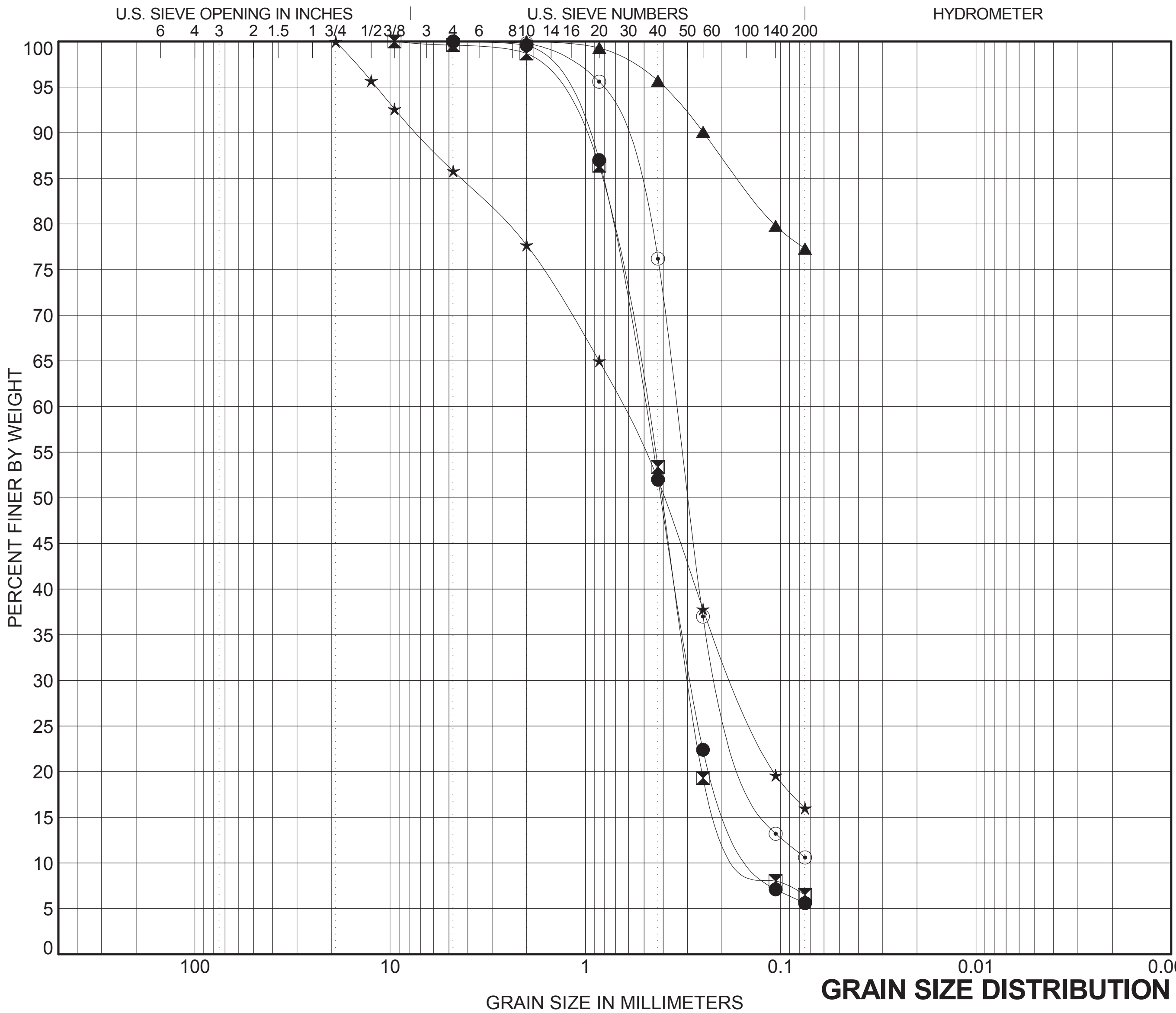
Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO: 2009-138-400

PLATE NO: B-3D



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	S0005A	S09	41.0	Poorly graded SAND with SILT				1.32	3.99
⧗	S0005A	S12	56.0	Poorly graded SAND with SILT				1.45	3.96
▲	S0005A	S15	70.0						
★	S0005A	S17	81.0	SILTY SAND					
⊙	S0005A	S18	86.0	Poorly graded SAND with SILT				1.60	4.93

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	S0005A	S09	41.0	4.75	0.498	0.286	0.125	0.0	94.4	5.6	
⧗	S0005A	S12	56.0	9.5	0.488	0.295	0.123	0.4	93.1	6.5	
▲	S0005A	S15	70.0	2				0.0	22.7	77.3	
★	S0005A	S17	81.0	19	0.651	0.173		14.2	69.8	16.0	
⊙	S0005A	S18	86.0	4.75	0.341	0.194		0.0	89.4	10.6	

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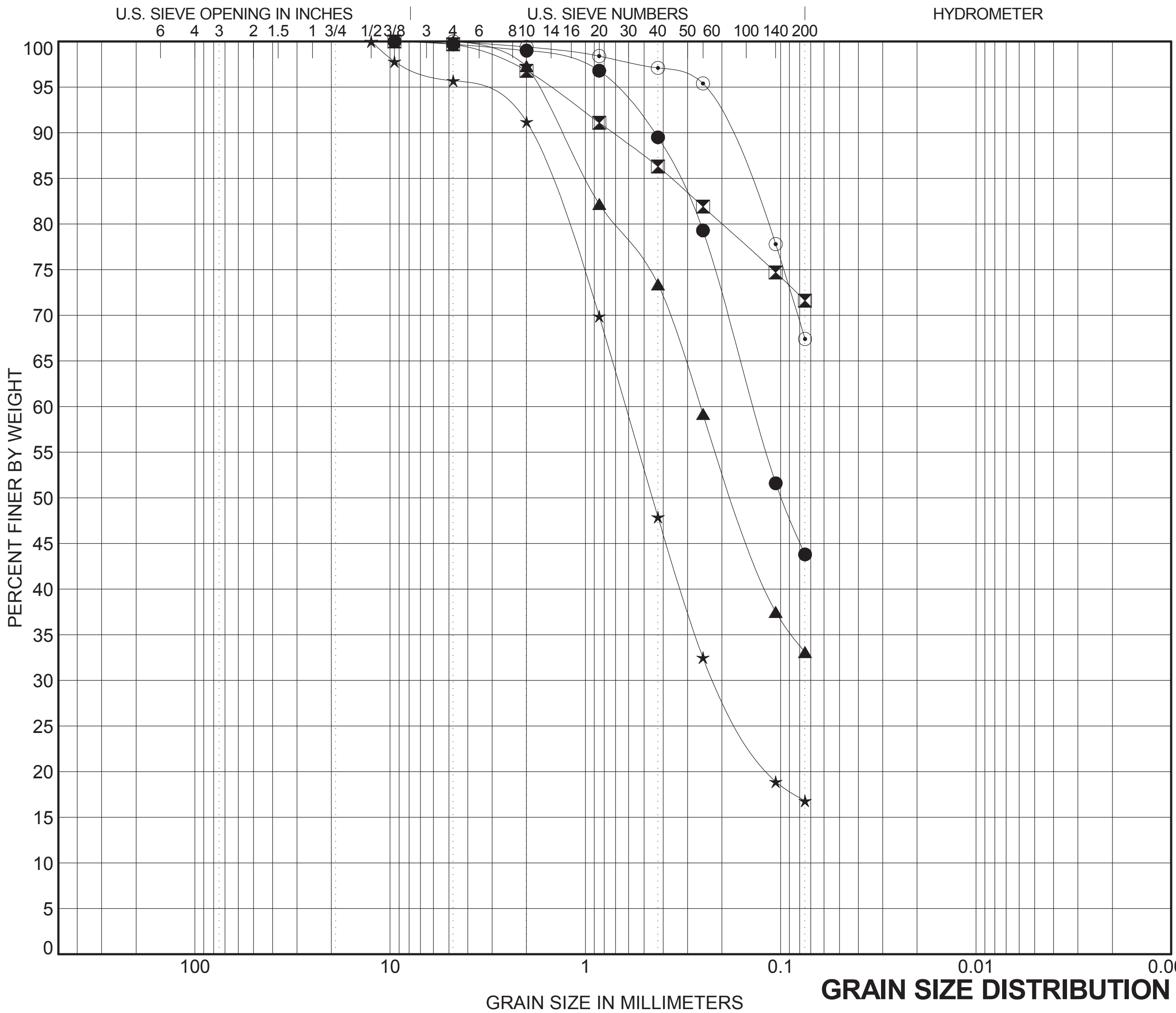
MATERIALS ENGINEERING

Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO: 2009-138-400

PLATE NO: B-3E



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	S0005A	S21	101.0	SILTY SAND					
⧗	S0005A	S24	116.0	SILT with SAND					
▲	S0006A	BULK	4.0	SILTY SAND					
★	S0006A	S03	11.0	SILTY SAND					
⊙	S0006A	S06	26.0	SILTY SAND					

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	S0005A	S21	101.0	9.5	0.138			0.3	55.9	43.8	
⧗	S0005A	S24	116.0	9.5				0.3	28.1	71.6	
▲	S0006A	BULK	4.0	4.75	0.258			0.0	66.9	33.1	
★	S0006A	S03	11.0	12.5	0.622	0.214		4.3	78.9	16.8	
⊙	S0006A	S06	26.0	4.75				0.0	32.6	67.4	

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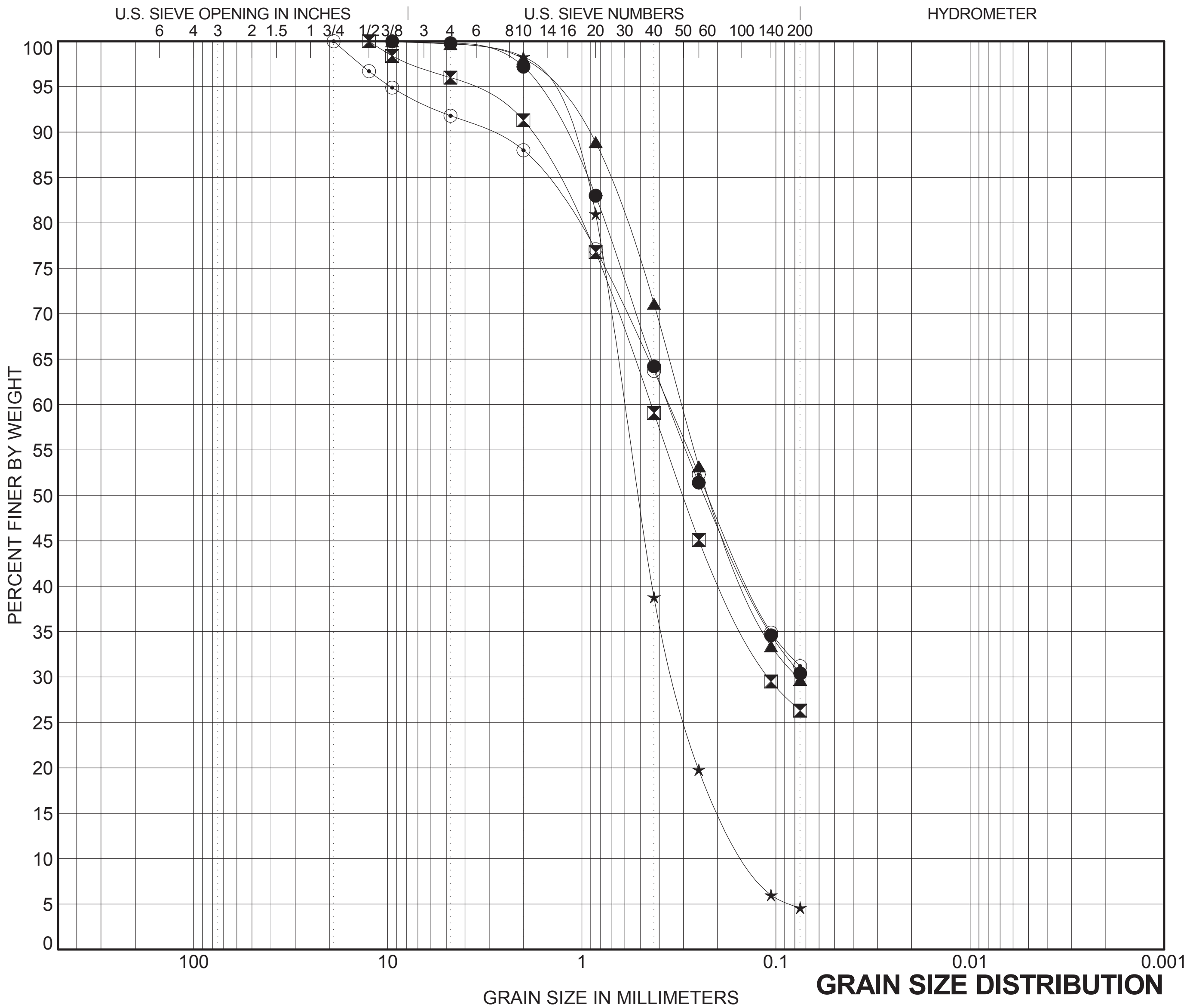
Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO:2009-138-400

PLATE NO: **B-3F**



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	S0007A	S01	3.0	SILTY SAND					
⧗	S0007A	BULK	4.0	SILTY SAND					
▲	S0007A	S04	16.0	SILTY SAND					
★	S0007A	S06	26.0	SILTY SAND				1.35	4.43
⊙	S0008A	BULK	4.0	SILTY SAND					

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	S0007A	S01	3.0	9.5	0.357			0.2	69.4	30.4	
⧗	S0007A	BULK	4.0	12.5	0.44	0.109		4.0	69.7	26.3	
▲	S0007A	S04	16.0	9.5	0.306	0.077		0.3	70.0	29.7	
★	S0007A	S06	26.0	9.5	0.602	0.332	0.136	0.3	95.1	4.6	
⊙	S0008A	BULK	4.0	19	0.358			8.2	60.6	31.2	

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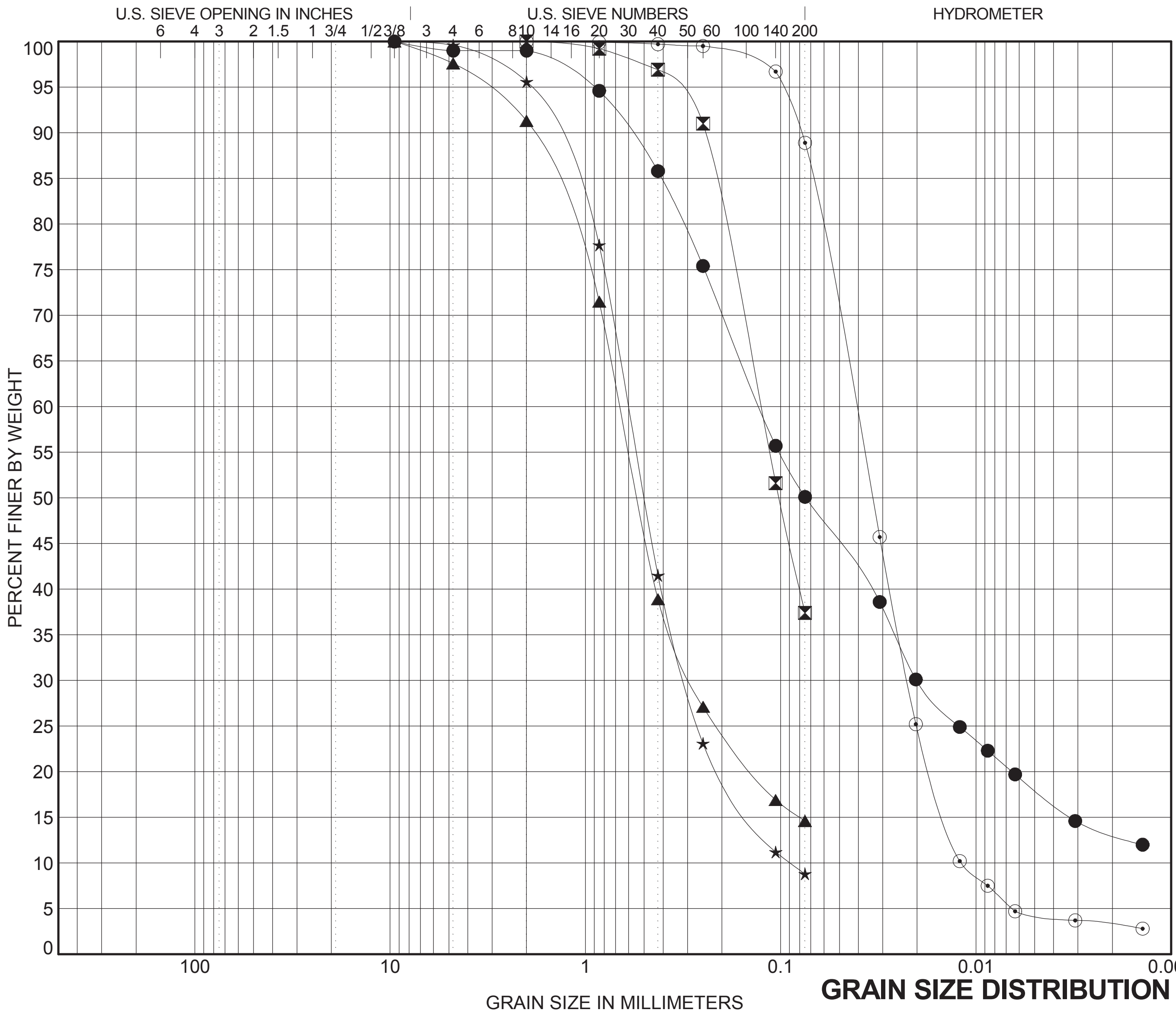
MATERIALS ENGINEERING

Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO: 2009-138-400 | **PLATE NO:** B-3G



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	**S0008A**	**S02**	**6.0**	**SANDY SILT**					
⧗	**S0008A**	**S05**	**21.0**	**SILTY SAND**					
▲	**S0008A**	**S08**	**26.0**	**SILTY SAND**					
★	**S0008A**	**S11**	**51.0**	**Well-graded SAND with SILT**				**1.72**	**6.79**
⊙	**S0008A**	**S14**	**66.0**	**SILT**				**1.02**	**3.52**

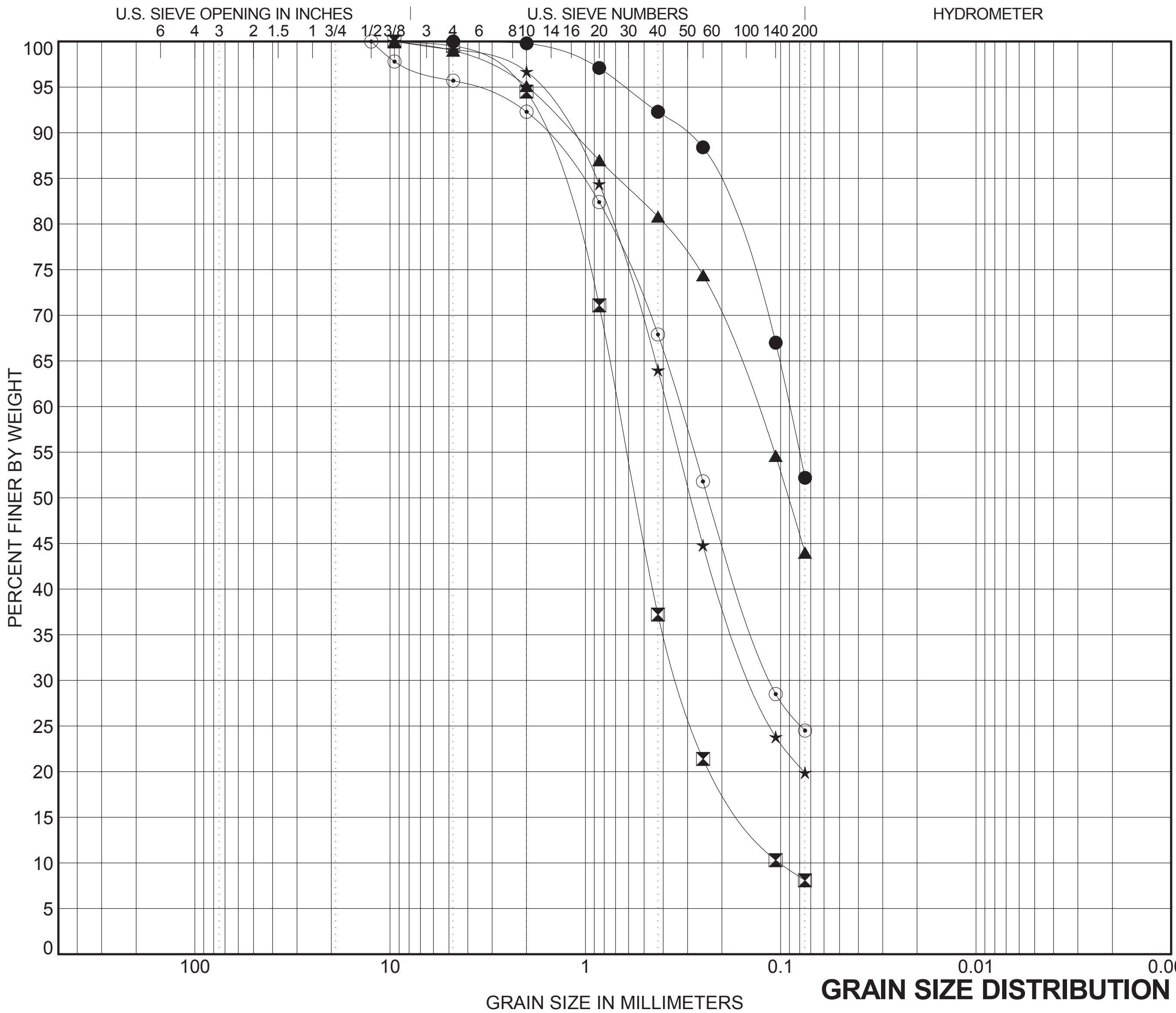
	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**S0008A**	**S02**	**6.0**	**9.5**	**0.128**	**0.02**		**1.0**	**48.9**	**32.1**	**18.0**
⧗	**S0008A**	**S05**	**21.0**	**2**	**0.127**			**0.0**	**62.6**	**37.4**	
▲	**S0008A**	**S08**	**26.0**	**9.5**	**0.666**	**0.285**		**2.4**	**83.0**	**14.6**	
★	**S0008A**	**S11**	**51.0**	**9.5**	**0.606**	**0.305**	**0.089**	**0.4**	**90.8**	**8.8**	
⊙	**S0008A**	**S14**	**66.0**	**2**	**0.042**	**0.022**	**0.012**	**0.0**	**11.1**	**84.5**	**4.4**

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO:2009-138-400

PLATE NO: B-3H



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	**S0008A**	**S20**	**96.0**	**SANDY SILT**					
⧗	**S0008A**	**S22**	**106.0**	**Well-graded SAND with SILT**				**1.63**	**6.70**
▲	**S0008A**	**S24**	**116.0**	**SILTY SAND**					
★	**S0009R**	**S01**	**2.0**	**SILTY SAND**					
⊙	**S0009R**	**BULK**	**4.0**	**SILTY SAND**					

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**S0008A**	**S20**	**96.0**	**4.75**	**0.09**			**0.0**	**47.8**	**52.2**	
⧗	**S0008A**	**S22**	**106.0**	**9.5**	**0.677**	**0.334**	**0.101**	**0.5**	**91.4**	**8.1**	
▲	**S0008A**	**S24**	**116.0**	**9.5**	**0.134**			**1.0**	**55.0**	**44.0**	
★	**S0009R**	**S01**	**2.0**	**9.5**	**0.381**	**0.137**		**0.9**	**79.2**	**19.9**	
⊙	**S0009R**	**BULK**	**4.0**	**12.5**	**0.328**	**0.112**		**4.3**	**71.2**	**24.5**	

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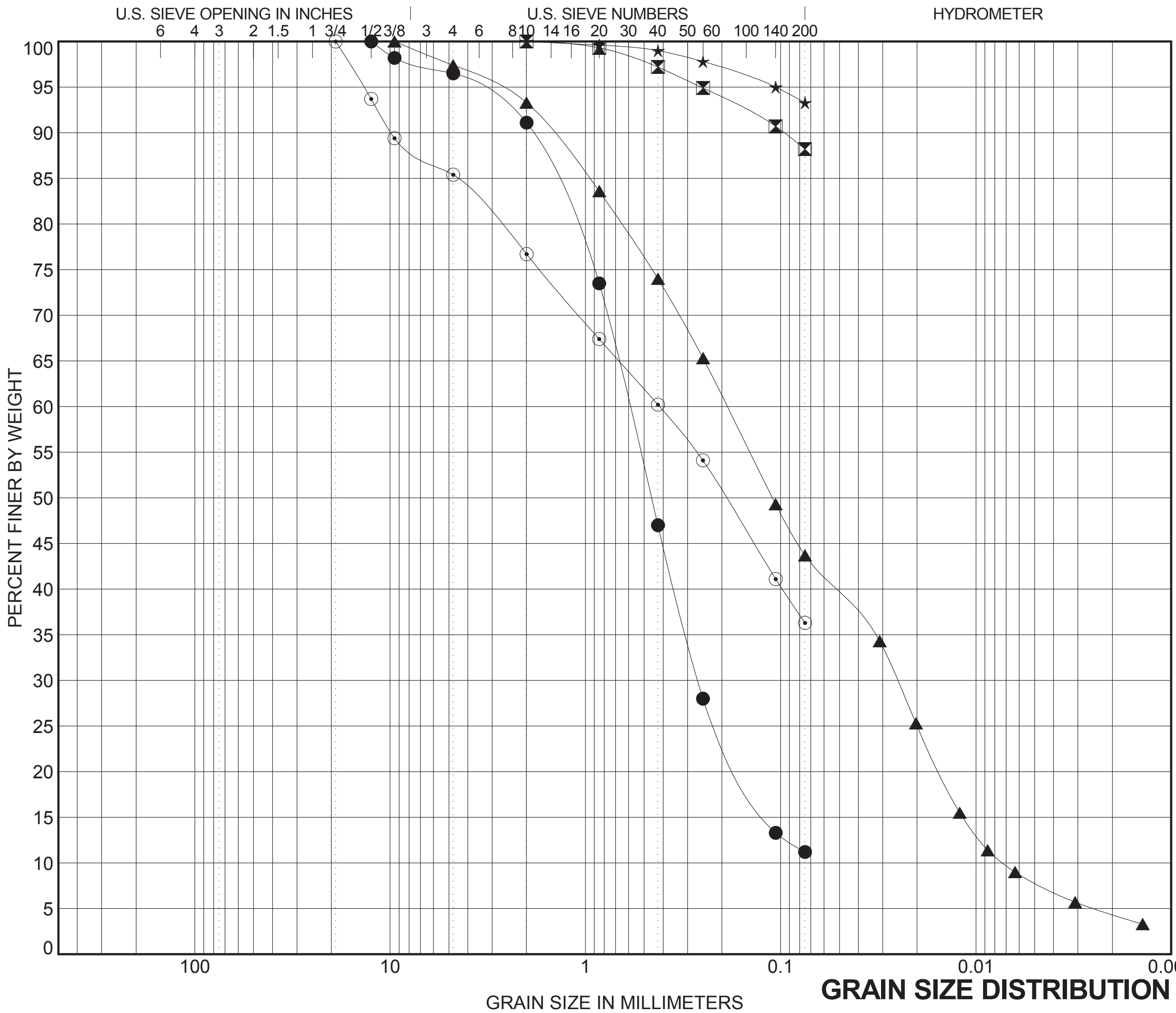
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO: 2009-138-400 | **PLATE NO:** B-3I



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	S0009R	S04	16.0	**Well-graded SAND with SILT**				1.90	9.70
⧗	S0009R	S07	31.0	**SILT**					
▲	S0009R	S11	51.0	**SILTY SAND**				0.47	26.11
★	S0009R	S17	81.0	**SILT**					
☉	S0009R	S18	86.0	**CLAYEY SAND**					

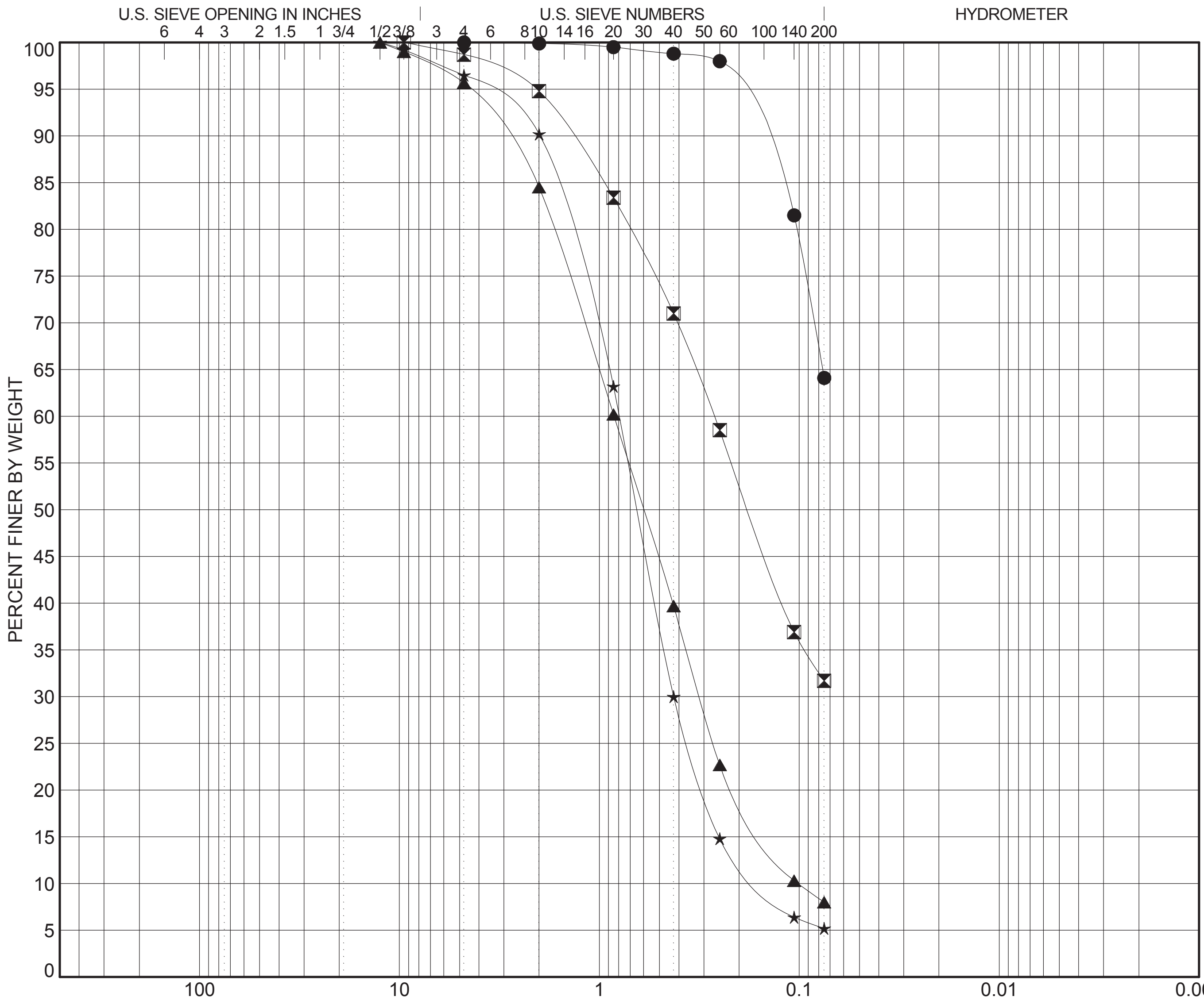
	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	S0009R	S04	16.0	12.5	0.597	0.264		3.5	85.3	11.2	
⧗	S0009R	S07	31.0	2				0.0	11.8	88.2	
▲	S0009R	S11	51.0	9.5	0.188	0.025	0.007	2.6	53.7	35.8	7.9
★	S0009R	S17	81.0	2				0.0	6.7	93.3	
☉	S0009R	S18	86.0	19	0.418			14.6	49.1	36.3	

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO: 2009-138-400

PLATE NO: B-3J



GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	SAMPLE #	DEPTH (ft)	Classification	LL	PL	PI	Cc	Cu
●	S0009R	S20	96.0	SANDY SILT					
⧗	S0010A	BULK	4.0	SILTY SAND					
▲	S0010A	S03	11.0	Poorly graded SAND with SILT				1.15	8.33
★	S0010A	S06	26.0	Poorly graded SAND with SILT				1.48	5.19

	BORING	SAMPLE #	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	S0009R	S20	96.0	4.75				0.0	35.9	64.1	
⧗	S0010A	BULK	4.0	9.5	0.266			1.3	67.0	31.7	
▲	S0010A	S03	11.0	12.5	0.844	0.314	0.101	4.3	87.7	8.0	
★	S0010A	S06	26.0	12.5	0.795	0.425	0.153	3.5	91.3	5.2	

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Minimum ARRA-funded Segment
Merced to Fresno Section of the California High-Speed Train Project,

JOB NO:2009-138-400 | **PLATE NO:** B-3K

Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils (Quick Undrained)

Client	AECOM	Lab Ref	G757
Project	CALIFORNIA HIGH-SPEED TRAIN PROJECT	Job	2009-138-400
Borehole	S0001A	Sample	S12

Test & Sample Details			
Standard	ASTM D2850-95 / AASHTO T296-94	Sample Depth	56.00 ft
Sample Type	Modified California Sampler	Sp. Gravity of Solids	2.65
Sample Description	Silt, yellowish brown	Lab. Temperature	75.4 deg.F
Variations from Procedure	None		

Specimen Details			
Specimen Reference	A	Stage Reference	1
Initial Height	5.0000 in	Description	
Initial Diameter	2.4160 in	Depth within Sample	0.0000 in
Initial Dry Unit Weight	99.30 lbf/ft3	Orientation within Sample	
Initial Moisture Content*	24.7 % (trimmings: 23.6 %)	Preparation	
Void Ratio	0.67	Degree of Saturation	98.21%
Comments			

* Calculated from initial and dry weights of whole specimen

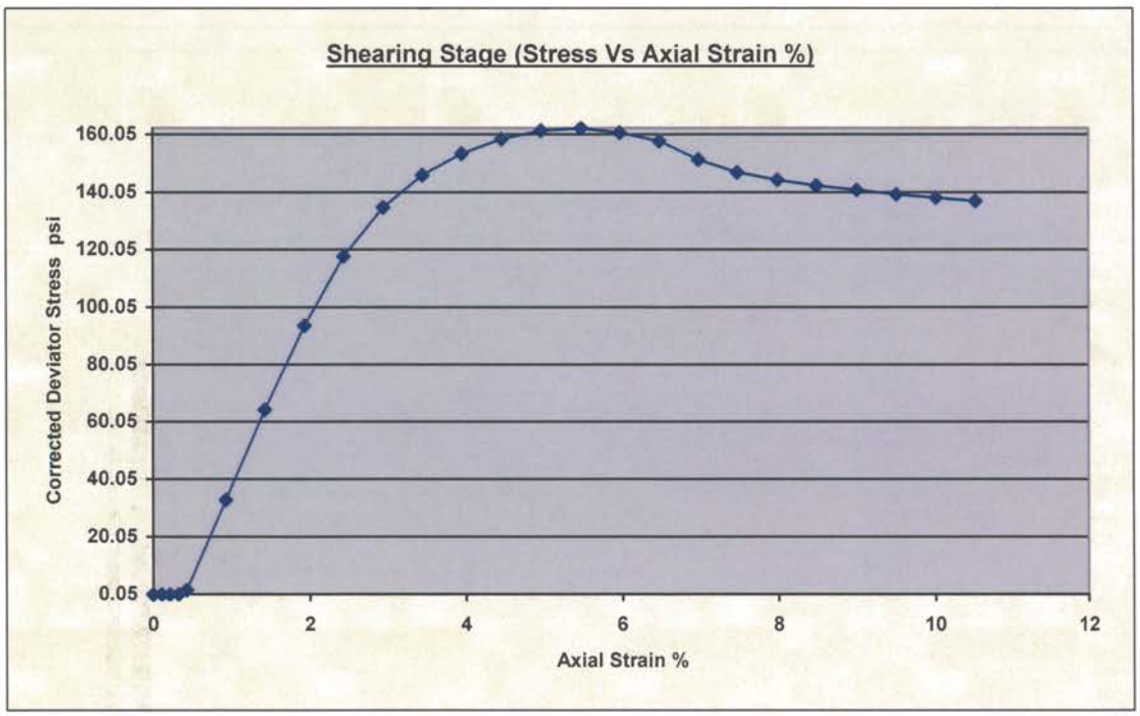


PLATE NO: B-4A-1

Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils (Quick Undrained)

Client	AECOM	**Lab Ref**	G757
Project	CALIFORNIA HIGH-SPEED TRAIN PROJECT	**Job**	2009-138-400
Borehole	S0001A	**Sample**	S12

Shear Conditions			
Rate of Axial Strain	0.30%/min	**Cell Pressure**	48.58psi

Conditions at Failure			
Failure Criterion	Maximum Deviator Stress		
Compressive Strength	162.28 psi	**Major Principal Stress**	210.86 psi
Axial Strain	5.47%	**Minor Principal Stress**	48.58 psi
Deviator Stress Correction Applied	0.220psi	**Final Moisture Content**	24.6 %
Final Unit Weight	123.68 lbf/ft3		

Tested By and Date:	P Dayah 11/10/11
Checked By and Date:	
Approved By and Date:	

Mode of Failure

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0001A#S02 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126289.

EVALUATION FOR SOIL CORROSION

Soil pH	6.31	
Minimum Resistivity	2.60 ohm-cm (x1000)	
Chloride	40.5 ppm	00.00405 %
Sulfate	26.6 ppm	00.00266 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney RH
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0002A#S02 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126290.

EVALUATION FOR SOIL CORROSION

Soil pH	6.56	
Minimum Resistivity	5.36 ohm-cm (x1000)	
Chloride	5.4 ppm	00.00054 %
Sulfate	0.8 ppm	00.00008 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0003A#S02 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126291.

EVALUATION FOR SOIL CORROSION

Soil pH	7.84	
Minimum Resistivity	2.95 ohm-cm (x1000)	
Chloride	10.4 ppm	00.00104 %
Sulfate	25.8 ppm	00.00258 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney RH
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0005A#S02 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126296.

EVALUATION FOR SOIL CORROSION

Soil pH	8.16	
Minimum Resistivity	0.99 ohm-cm (x1000)	
Chloride	27.3 ppm	00.00273 %
Sulfate	45.4 ppm	00.00454 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO: B- 5D

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr. Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0006A#2 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126292.

EVALUATION FOR SOIL CORROSION

Soil pH	7.83	
Minimum Resistivity	7.50 ohm-cm (x1000)	
Chloride	14.0 ppm	00.00140 %
Sulfate	15.8 ppm	00.00158 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0007A#2 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126294.

EVALUATION FOR SOIL CORROSION

Soil pH	8.09	
Minimum Resistivity	3.75 ohm-cm (x1000)	
Chloride	8.2 ppm	00.00082 %
Sulfate	15.0 ppm	00.00150 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0008A#S03 @ 11.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126293.

EVALUATION FOR SOIL CORROSION

Soil pH	7.41	
Minimum Resistivity	3.22 ohm-cm (x1000)	
Chloride	13.6 ppm	00.00136 %
Sulfate	11.9 ppm	00.00119 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO: B- 5G

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney RH
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0009A#2 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126295.

EVALUATION FOR SOIL CORROSION

Soil pH	8.88		
Minimum Resistivity	5.90 ohm-cm (x1000)		
Chloride	6.1 ppm	00.00061 %	
Sulfate	10.0 ppm	00.00100 %	

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/07/2011
Date Submitted 12/01/2011

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-138-400/CA.HSTP Site ID : S0010A#S02 @ 6'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61450-126297.

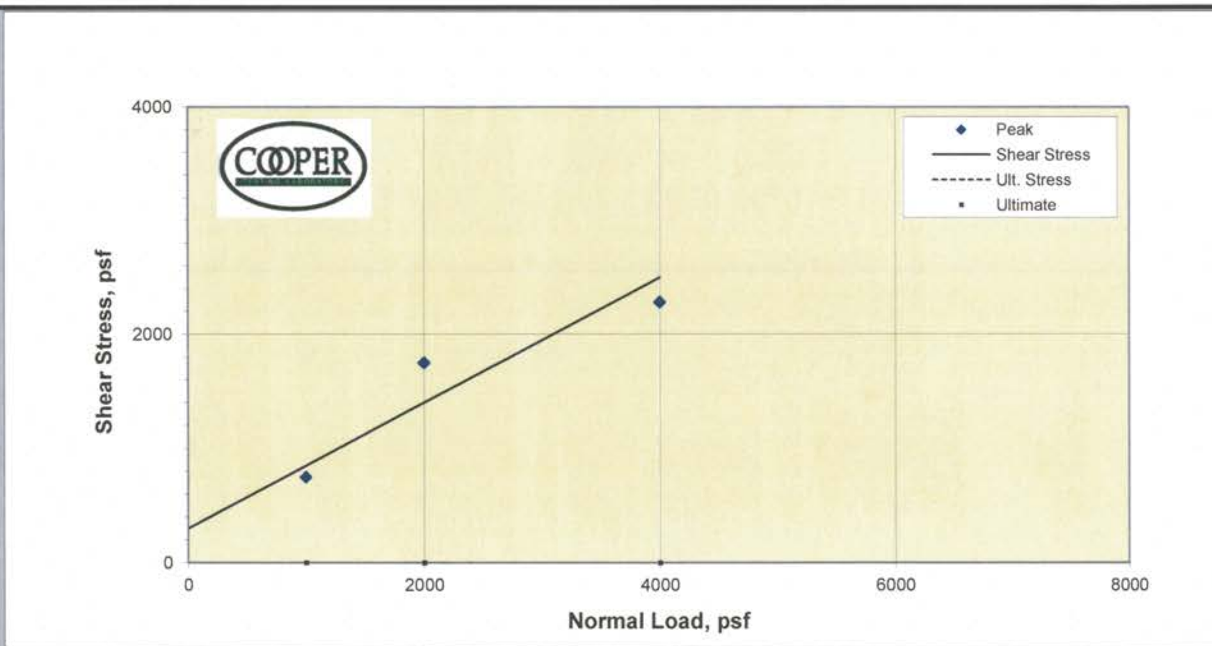
EVALUATION FOR SOIL CORROSION

Soil pH	7.38	
Minimum Resistivity	13.40 ohm-cm (x1000)	
Chloride	6.0 ppm	00.00060 %
Sulfate	0.1 ppm	00.00001 %

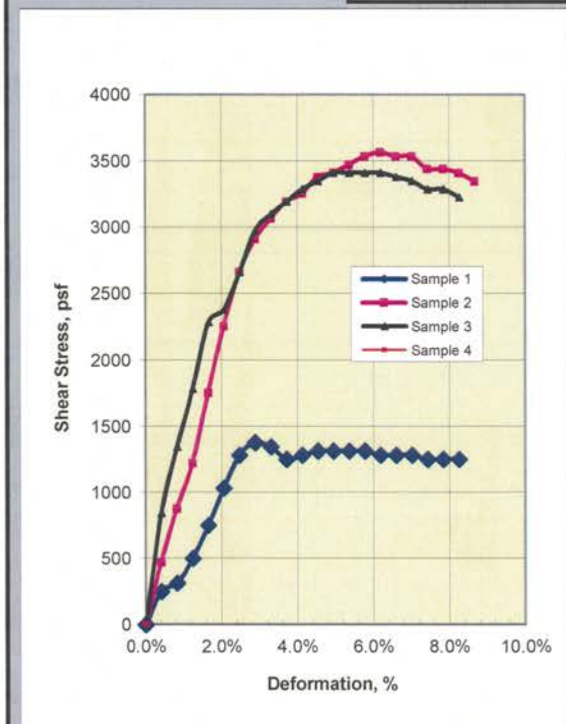
METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	28.8	Ult. Phi (degrees)	
P. Cohesion (psf)	300	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	4.2%	4.4%	8.2%	
Dry Dens., pcf	93.4	96.4	93.6	
Void Ratio	0.804	0.749	0.801	
Saturation %	14.3	15.7	27.7	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	28.4%	26.4%	25.4%	
Dry Dens., pcf	95.4	98.4	100.1	
Void Ratio	0.768	0.714	0.685	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.979	0.979	0.935	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	751	1753	2285	
Strengths picked at	2.0%	2.0%	2.0%	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0001A	S10	46	Olive Brown Silty SAND w/ Gravel
2	S0001A	S10	46	Olive Brown Silty SAND w/ Gravel
3	S0001A	S10	46	Olive Brown Silty SAND w/ Gravel

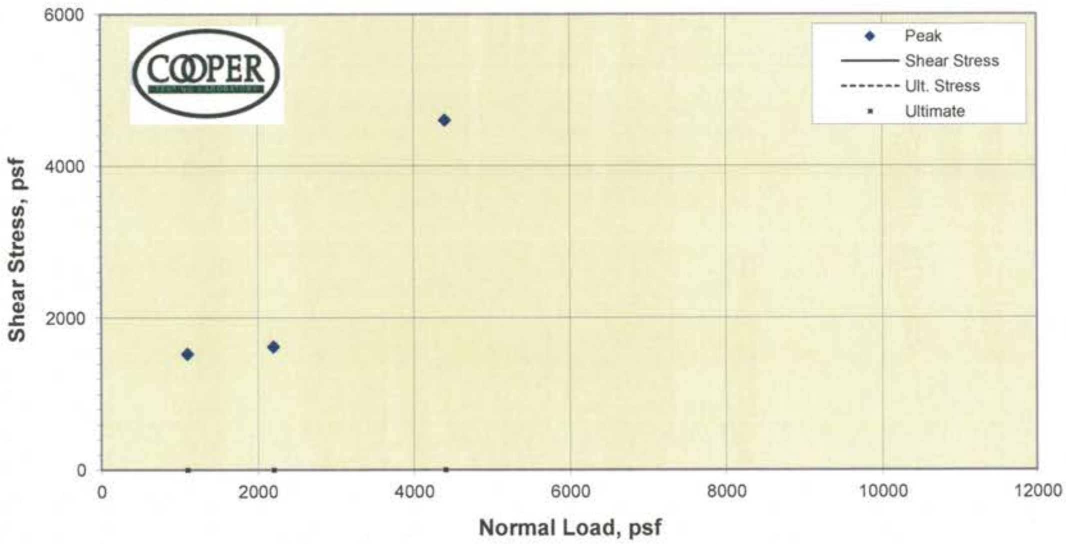
Remarks: Strengths were picked at 2% straain because the 2000 psf point exceeded the strength of the 3000 psf point after 2% strain.

DS-CU A fully undrained condition may not be attained in this test.

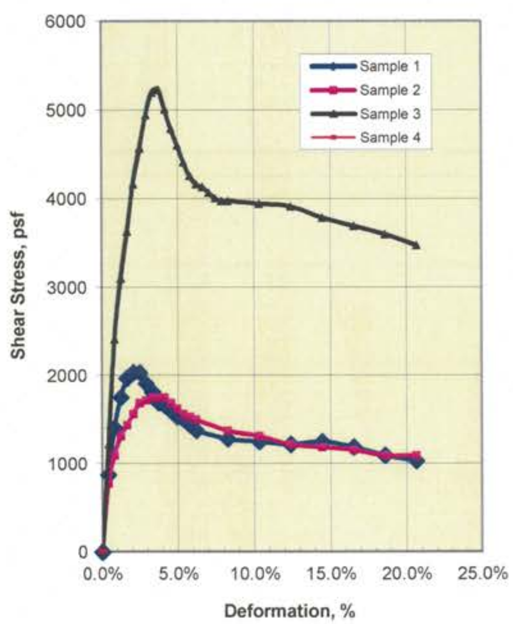
Plate No: B-6A

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	11.9%	10.7%	11.5%	
Dry Dens., pcf	116.5	108.5	119.5	
Void Ratio	0.447	0.553	0.411	
Saturation %	71.9	52.4	75.8	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	15.3%	17.5%	14.2%	
Dry Dens., pcf	119.3	114.6	121.8	
Void Ratio	0.413	0.471	0.384	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.976	0.947	0.981	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1534	1628	4602	
Strengths picked at	5.0%	5.0%	5.0%	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

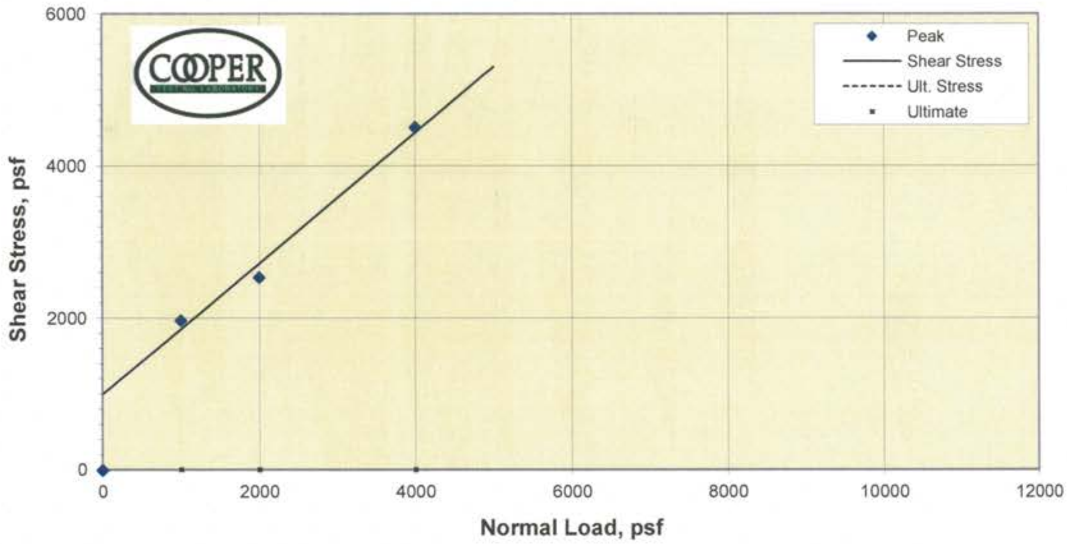
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0001A	S14	66	Reddish Brown Silty SAND (slightly plastic)
2	S0001A	S14	66	Reddish Brown Silty SAND (slightly plastic)
3	S0001A	S14	66	Reddish Brown Silty SAND (slightly plastic)
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

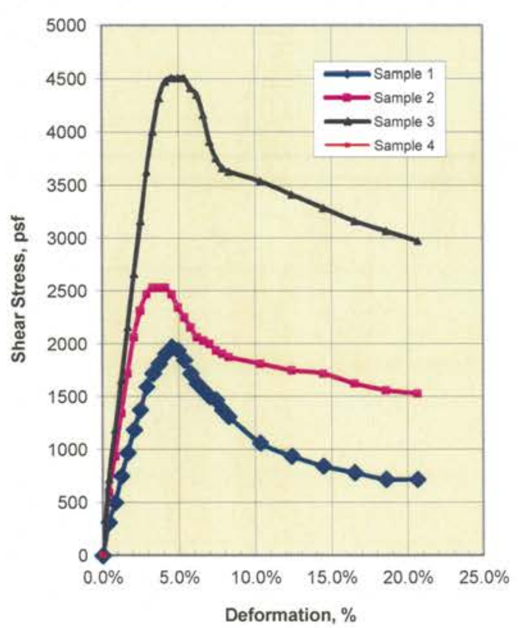
Plate No: B-6B

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	40.7	Ult. Phi (degrees)	
P. Cohesion (psf)	1000	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	29.2%	23.3%	25.1%	
Dry Dens., pcf	88.8	96.4	95.1	
Void Ratio	0.898	0.749	0.773	
Saturation %	87.7	83.8	87.7	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	29.9%	24.5%	26.1%	
Dry Dens., pcf	93.3	101.4	98.9	
Void Ratio	0.807	0.663	0.706	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.952	0.950	0.961	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1972	2536	4508	
Strengths picked at	Peak	Peak	Peak	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

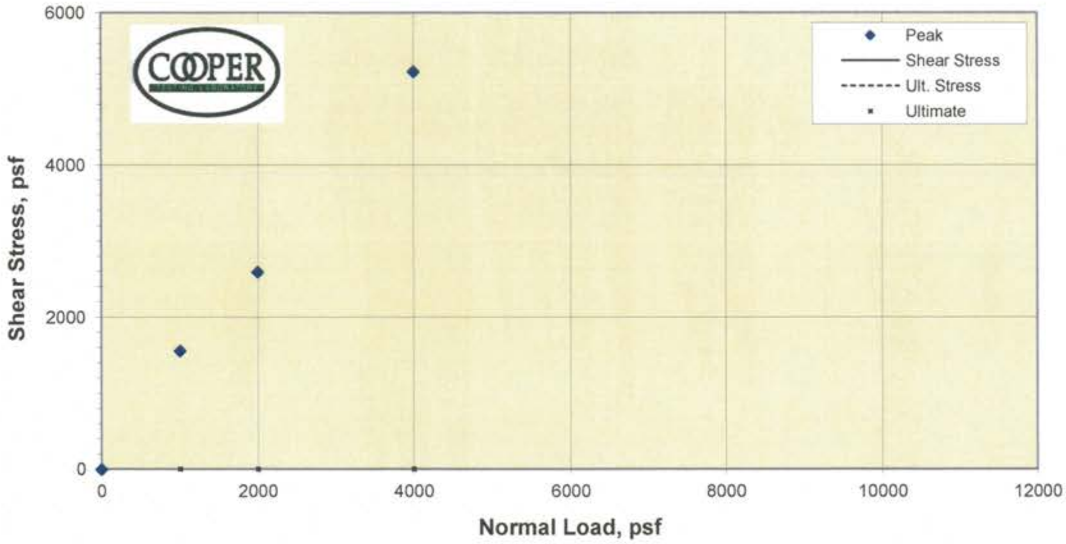
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0001A	S23	111	Light Olive Brown Silty SAND
2	S0001A	S23	111	Light Olive Brown Silty SAND
3	S0001A	S23	111	Light Olive Brown Silty SAND
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

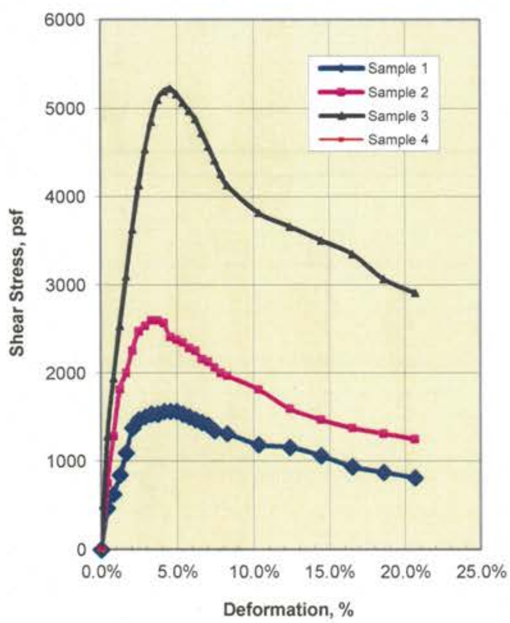
Plate No: B-6C

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	9.1%	10.7%	12.2%	
Dry Dens., pcf	112.2	115.9	118.8	
Void Ratio	0.502	0.454	0.419	
Saturation %	48.9	63.5	78.9	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	13.7%	13.0%	12.4%	
Dry Dens., pcf	123.0	124.8	126.3	
Void Ratio	0.371	0.352	0.336	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.912	0.929	0.941	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1565	2598	5228	
Strengths picked at	Peak	Peak	Peak	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

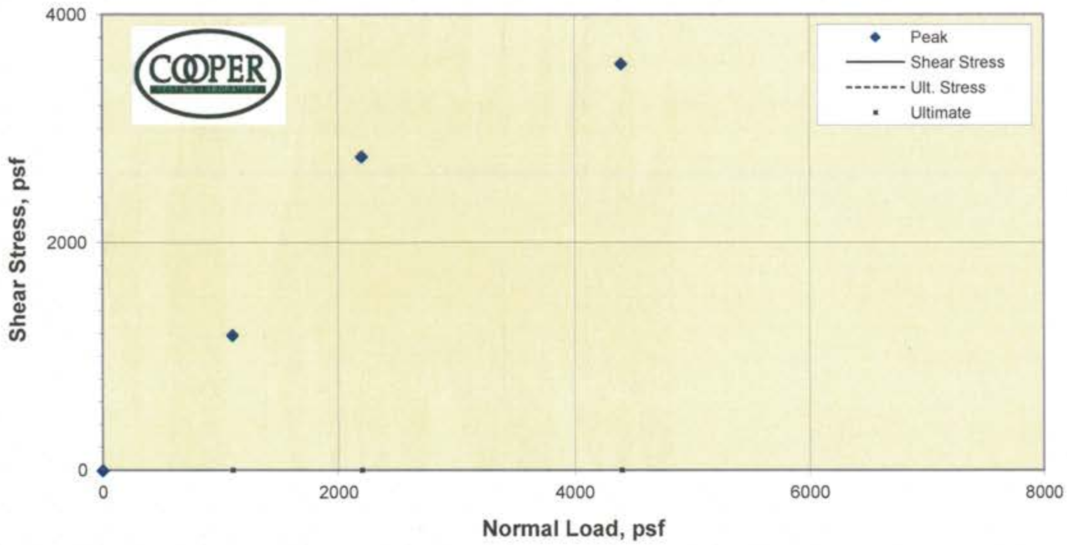
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0002A	S03	11	Brown Silty SAND
2	S0002A	S03	11	Brown Silty SAND
3	S0002A	S03	11	Brown Silty SAND
Remarks:	The friction angle exceeded 45 degrees, possible due to the angularity of the sand.			
	DS-CU A fully undrained condition may not be attained in this test.			

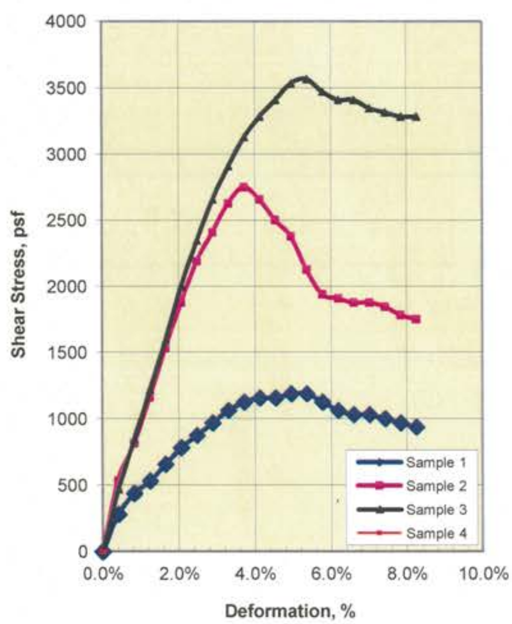
Plate No: B-6D

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



	1	2	3	4
Sample Data: Initial				
Moisture %	14.5%	12.9%	13.0%	
Dry Dens., pcf	96.3	99.8	100.3	
Void Ratio	0.751	0.690	0.681	
Saturation %	52.2	50.6	51.6	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	25.4%	22.1%	22.7%	
Dry Dens., pcf	100.1	105.6	104.6	
Void Ratio	0.685	0.598	0.612	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.961	0.945	0.958	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1190	2755	3569	
Strengths picked at	Peak	Peak	Peak	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

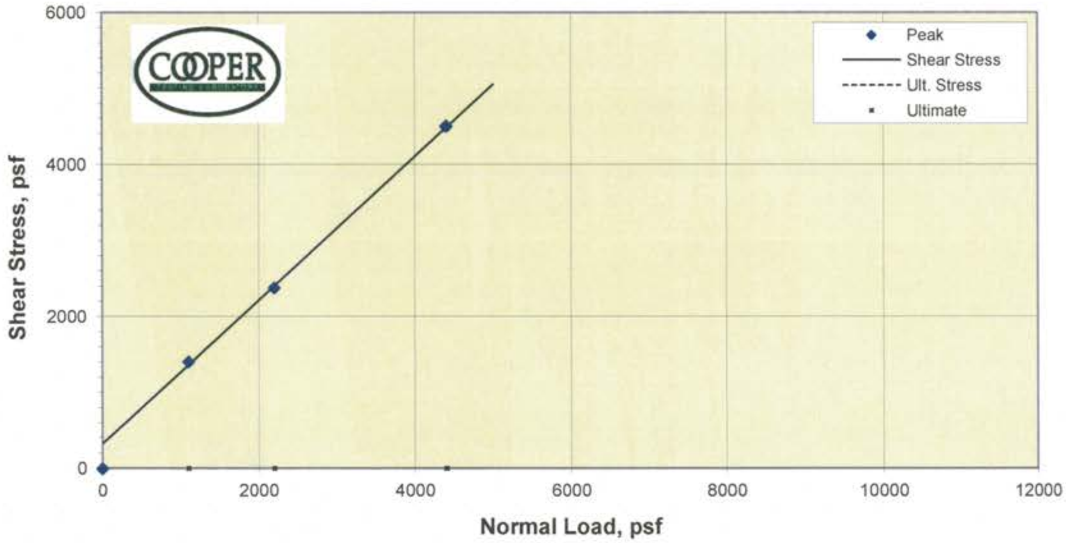
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0003A	S03	11	Light Brown Silty SAND
2	S0003A	S03	11	Light Brown Silty SAND
3	S0003A	S03	11	Light Brown Silty SAND
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

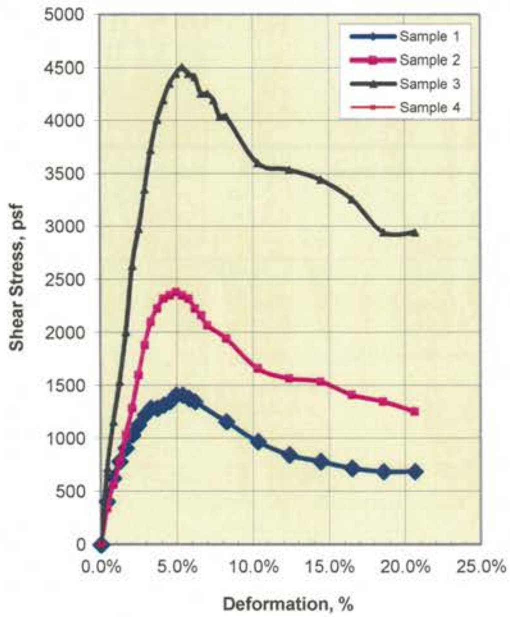
Plate No: B-6E

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	43.4	Ult. Phi (degrees)	
P. Cohesion (psf)	325	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	3.4%	3.8%	3.4%	
Dry Dens., pcf	100.3	100.0	102.3	
Void Ratio	0.681	0.685	0.648	
Saturation %	13.5	15.1	14.2	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	19.3%	19.2%	18.8%	
Dry Dens., pcf	110.8	111.0	111.9	
Void Ratio	0.522	0.519	0.507	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.905	0.901	0.914	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1409	2379	4508	
Strengths picked at	Peak	Peak	Peak	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0005A	7	31	Light Brown SAND
2	S0005A	7	31	Light Brown SAND
3	S0005A	7	31	Light Brown SAND

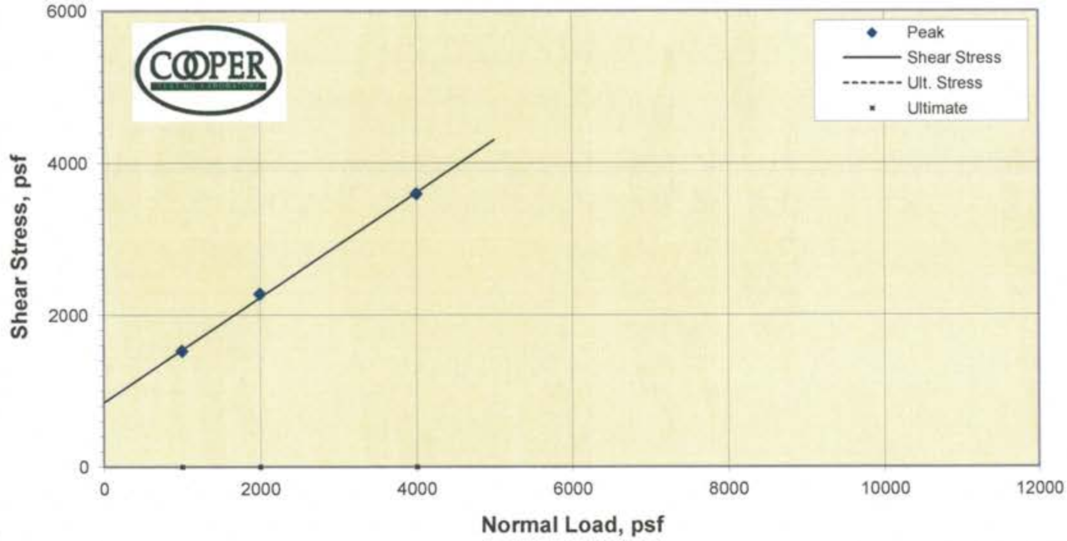
Remarks:

DS-CU A fully undrained condition may not be attained in this test.

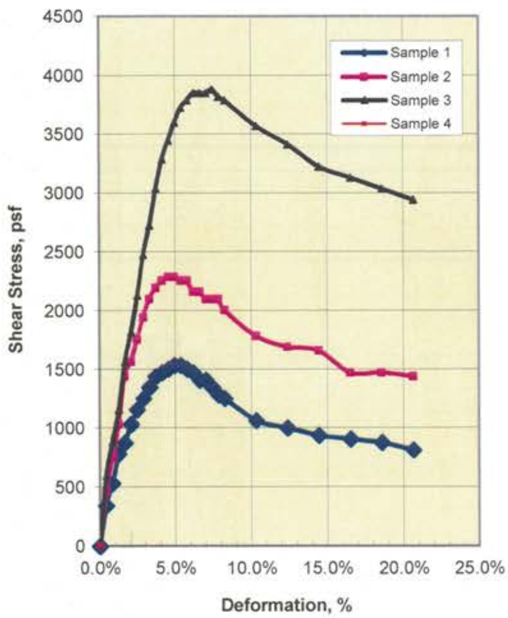
Plate No: B-6F

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	34.6	Ult. Phi (degrees)	
P. Cohesion (psf)	850	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	6.6%	8.6%	13.1%	
Dry Dens., pcf	102.4	102.2	100.7	
Void Ratio	0.645	0.649	0.673	
Saturation %	27.8	35.8	52.7	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	18.8%	20.0%	20.3%	
Dry Dens., pcf	112.0	109.6	109.0	
Void Ratio	0.507	0.539	0.548	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.915	0.932	0.924	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1534	2285	3600	
Strengths picked at	5.0%	5.0%	5.0%	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

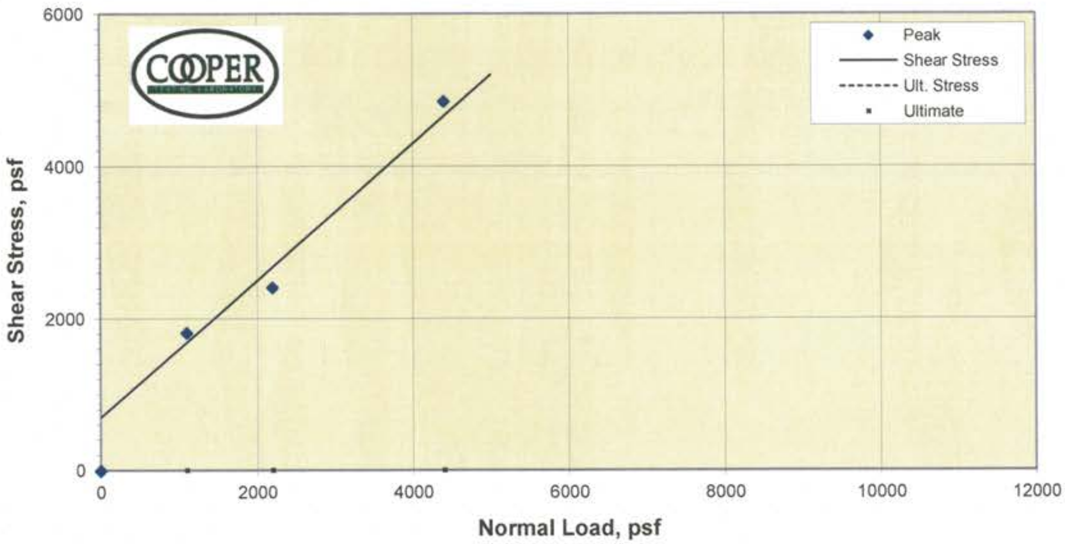
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0005A	14	66	Reddish Brown Silty SAND (slightly plastic)
2	S0005A	14	66	Reddish Brown Silty SAND (slightly plastic)
3	S0005A	14	66	Reddish Brown Silty SAND (slightly plastic)
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

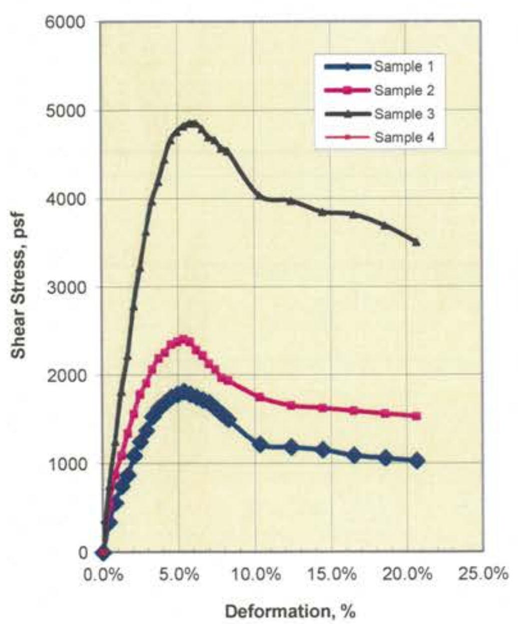
Plate No: B-6G

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	42.0	Ult. Phi (degrees)	
P. Cohesion (psf)	700	Ult. Cohesion (psf)	



	1	2	3	4
Sample Data: Initial				
Moisture %	25.1%	22.7%	21.1%	
Dry Dens., pcf	99.2	100.5	103.0	
Void Ratio	0.698	0.678	0.636	
Saturation %	97.0	90.6	89.7	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	23.2%	22.9%	21.0%	
Dry Dens., pcf	103.8	104.2	107.7	
Void Ratio	0.626	0.619	0.566	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.957	0.964	0.957	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1816	2411	4853	
Strengths picked at	Peak	Peak	Peak	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

CTL #:	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

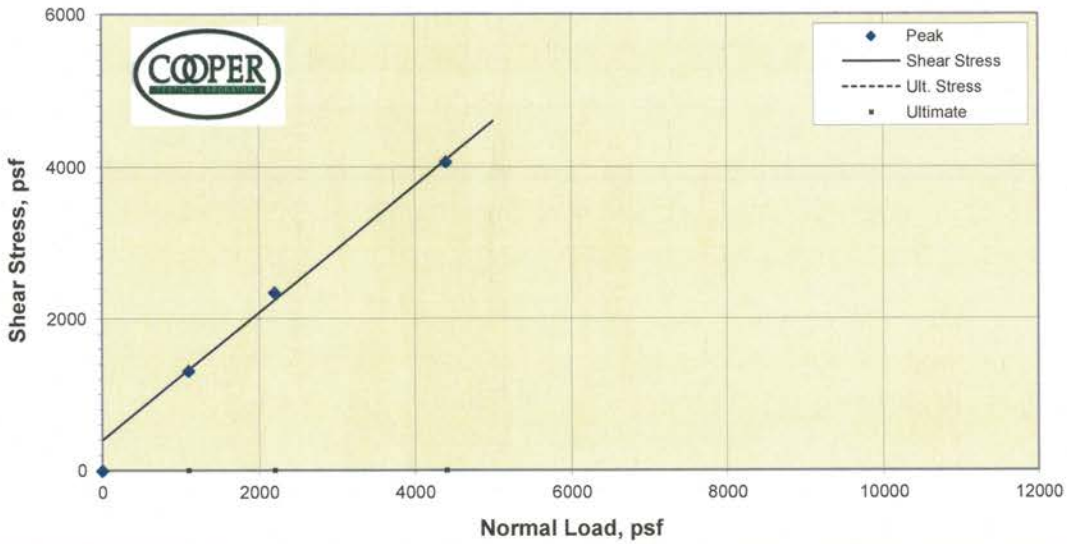
Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0005A	22	106	Brown Silty SAND
2	S0005A	22	106	Brown Silty SAND
3	S0005A	22	106	Brown Silty SAND

Remarks: *DS-CU* A fully undrained condition may not be attained in this test.

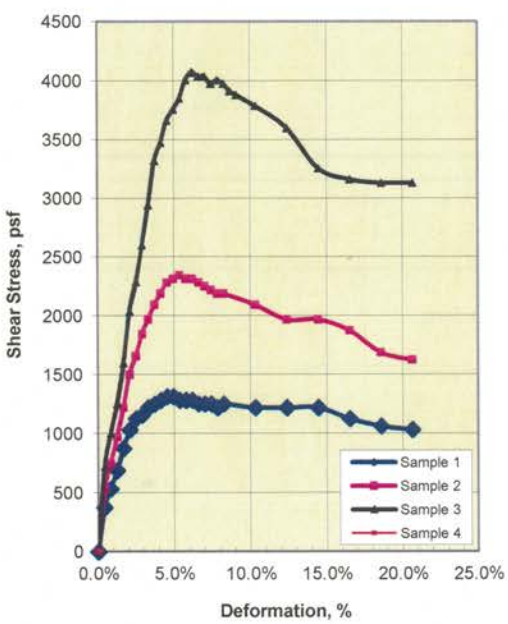
Plate No: B-6H

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	40.0	Ult. Phi (degrees)	
P. Cohesion (psf)	400	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	2.6%	5.3%	3.2%	
Dry Dens., pcf	98.4	98.3	98.4	
Void Ratio	0.713	0.715	0.713	
Saturation %	9.8	20.1	12.1	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	20.1%	21.4%	18.9%	
Dry Dens., pcf	109.3	106.9	111.6	
Void Ratio	0.543	0.578	0.511	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.900	0.920	0.882	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1315	2348	4070	
Strengths picked at	Peak	Peak	Peak	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

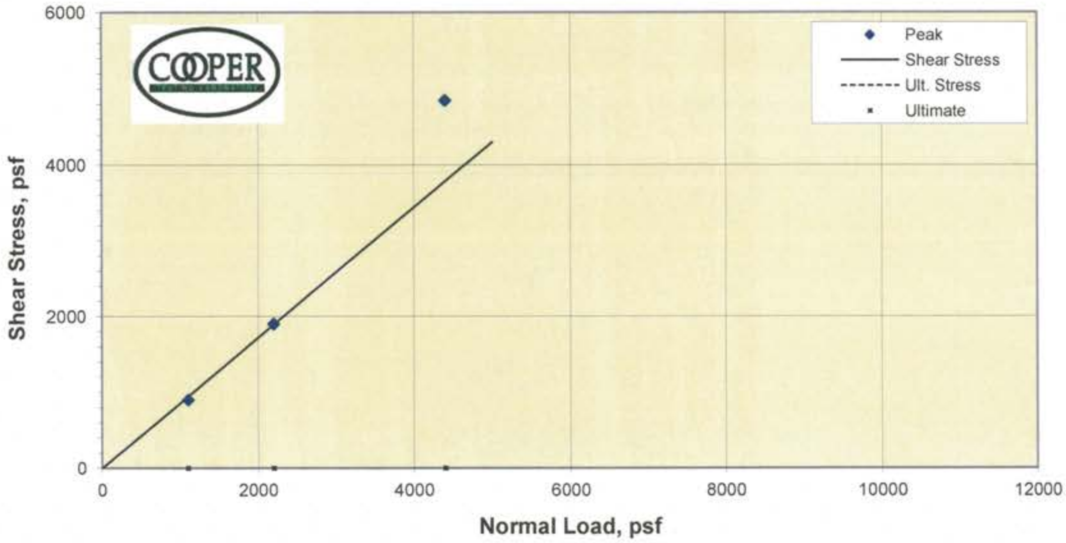
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0006A	4	16	Light Brown SAND
2	S0006A	4	16	Light Brown SAND
3	S0006A	4	16	Light Brown SAND
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

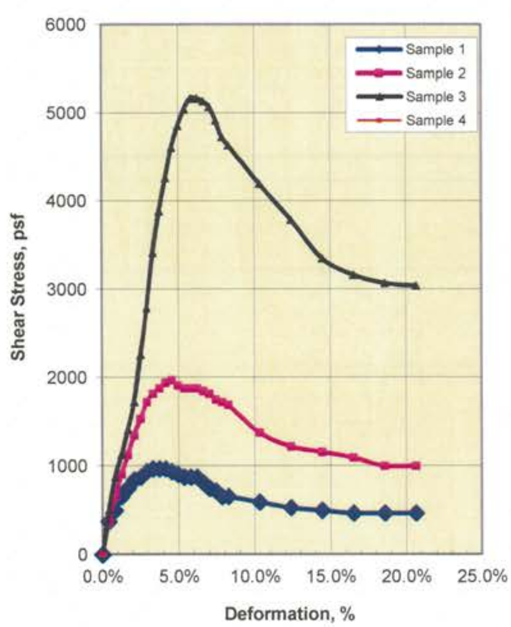
Plate No: B-6I

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	40.7	Ult. Phi (degrees)	
P. Cohesion (psf)	0	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	2.6%	2.7%	2.5%	
Dry Dens., pcf	94.0	93.0	97.8	
Void Ratio	0.794	0.812	0.724	
Saturation %	8.9	8.9	9.4	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	22.4%	23.5%	21.2%	
Dry Dens., pcf	105.0	103.2	107.2	
Void Ratio	0.606	0.635	0.573	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.894	0.901	0.912	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	908	1910	4853	
Strengths picked at	5.0%	5.0%	5.0%	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

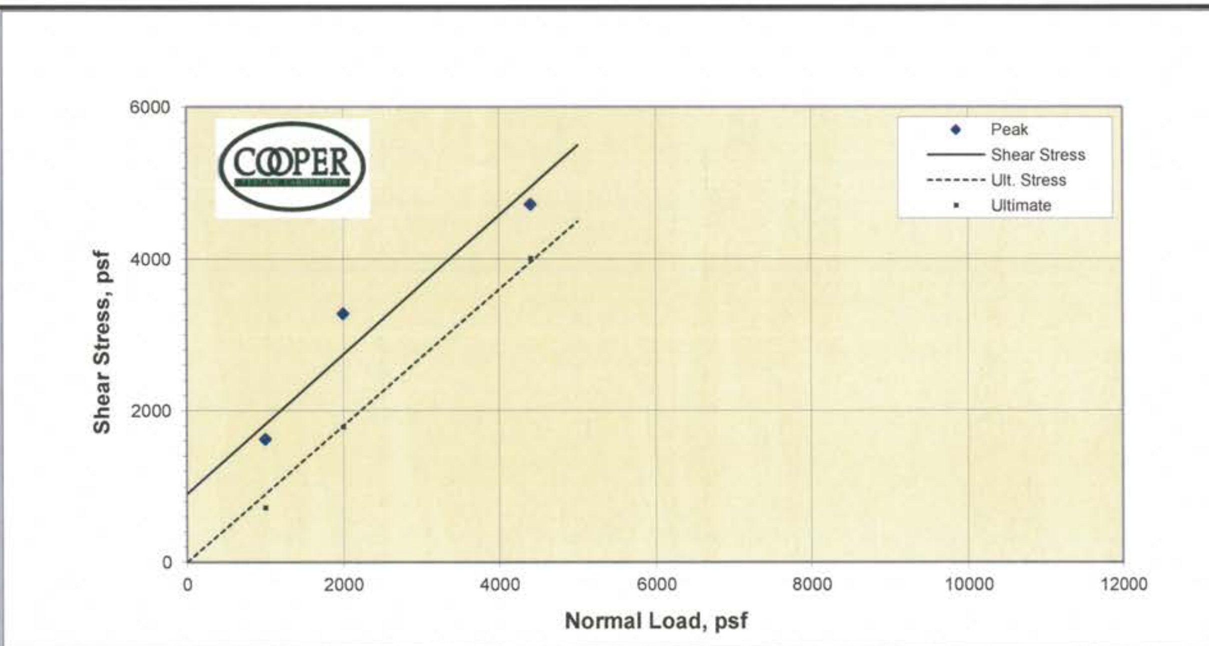
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0007A	7	31	Light Brown SAND
2	S0007A	7	31	Light Brown SAND
3	S0007A	7	31	Light Brown SAND
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

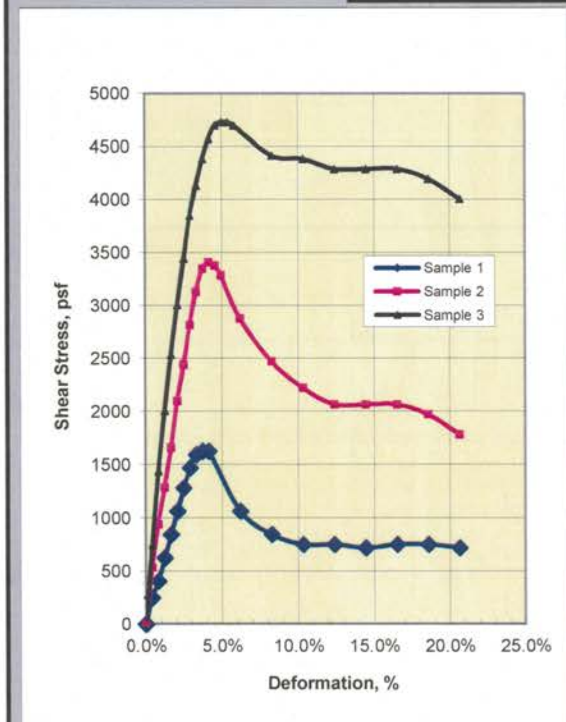
Plate No: B-6J

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	42.6	Ult. Phi (degrees)	42.0
P. Cohesion (psf)	900	Ult. Cohesion (psf)	0



	Sample Data: Initial			
	1	2	3	4
Moisture %	19.4%	22.8%	16.8%	
Dry Dens., pcf	76.3	67.9	80.6	
Void Ratio	1.209	1.482	1.090	
Saturation %	43.3	41.5	41.6	
Diameter	2.42	2.42	2.42	
Height	0.99	1.00	0.99	
	Sample Data: At Test			
Moisture %	35.8%	42.3%	32.0%	
Dry Dens., pcf	85.8	78.7	90.5	
Void Ratio	0.965	1.142	0.863	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.880	0.863	0.882	
Normal Stress, psf	1000	2000	4400	
Shear Stress, psf	1628	3287	4727	
Strengths picked at	5.0%	5.0%	5.0%	
Ult. Stress, psf	720	1785	4007	
Strain Rate, %/min.	1.0	1.0	1.0	

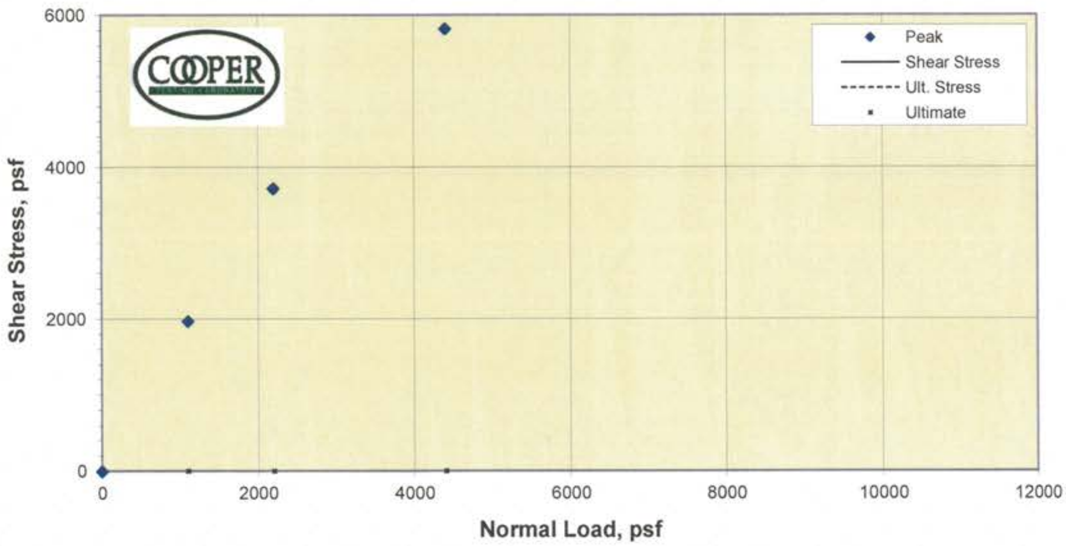
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0008A	S19	91	Light Brown Silty SAND
2	S0008A	S19	91	Light Brown Silty SAND
3	S0008A	S19	91	Light Brown Silty SAND
Remarks:	*DS-CU* A fully undrained condition may not be attained in this test.			

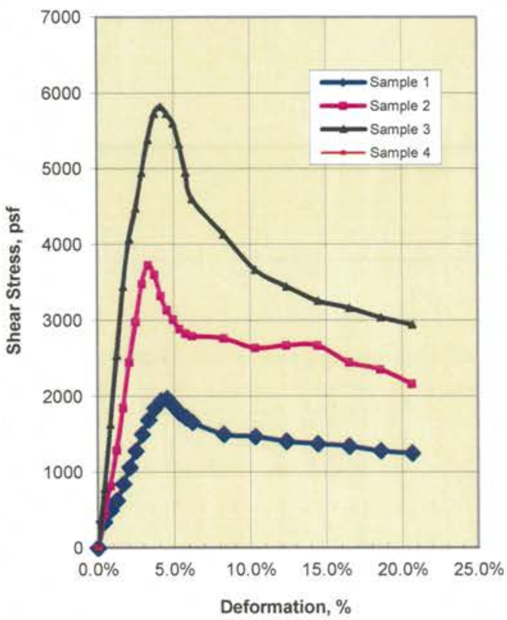
Plate No: B-6K

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	10.7%	11.8%	12.2%	
Dry Dens., pcf	112.4	114.4	115.7	
Void Ratio	0.499	0.473	0.457	
Saturation %	58.0	67.1	72.2	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.01	
	Sample Data: At Test			
Moisture %	14.9%	14.4%	14.2%	
Dry Dens., pcf	120.2	121.4	121.9	
Void Ratio	0.403	0.390	0.384	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.935	0.943	0.958	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1972	3726	5823	
Strengths picked at	Peak	Peak	Peak	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

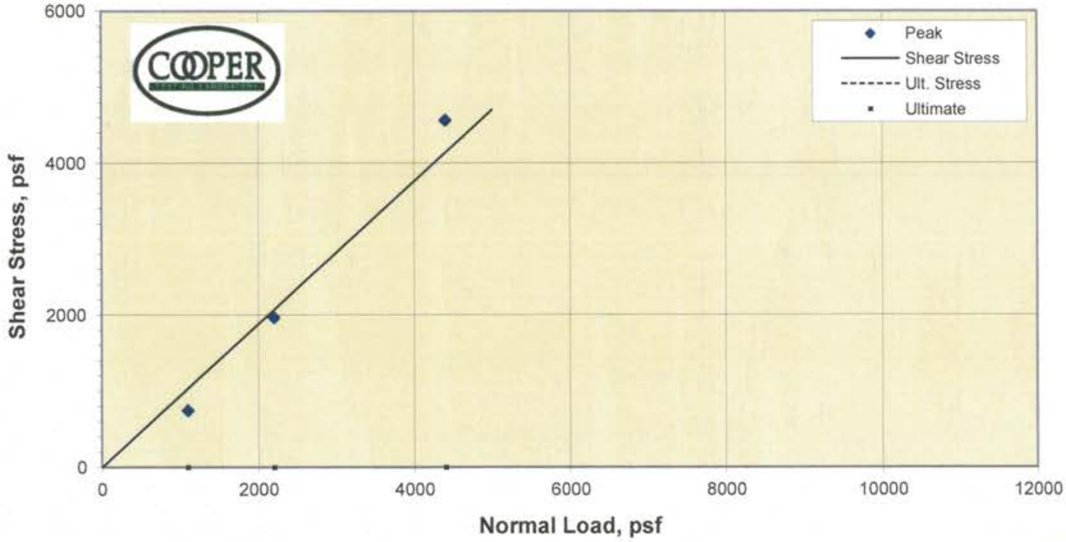
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0008A	S06	26	Olive Brown Silty SAND
2	S0008A	S06	26	Olive Brown Silty SAND
3	S0008A	S06	26	Olive Brown Silty SAND
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

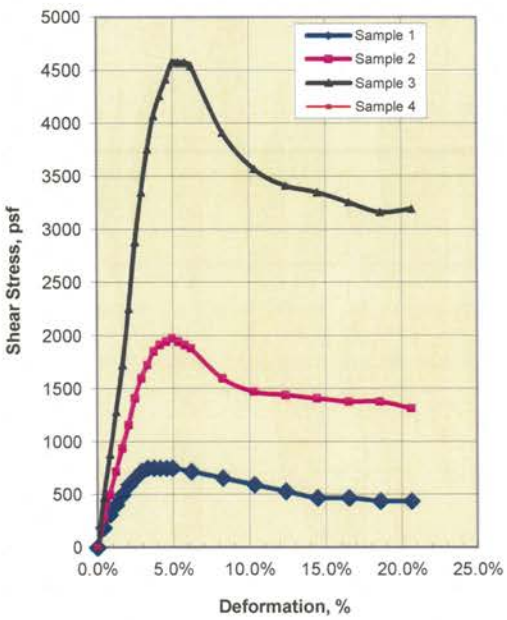
Plate No: B-6L

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	43.2	Ult. Phi (degrees)	
P. Cohesion (psf)	0	Ult. Cohesion (psf)	



	1	2	3	4
Sample Data: Initial				
Moisture %	1.5%	2.3%	2.1%	
Dry Dens., pcf	96.8	95.8	100.9	
Void Ratio	0.742	0.759	0.671	
Saturation %	5.5	8.3	8.3	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
Sample Data: At Test				
Moisture %	21.5%	20.8%	19.0%	
Dry Dens., pcf	106.6	108.0	111.5	
Void Ratio	0.582	0.563	0.513	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.907	0.888	0.904	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	751	1972	4571	
Strengths picked at	5.0%	5.0%	5.0%	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

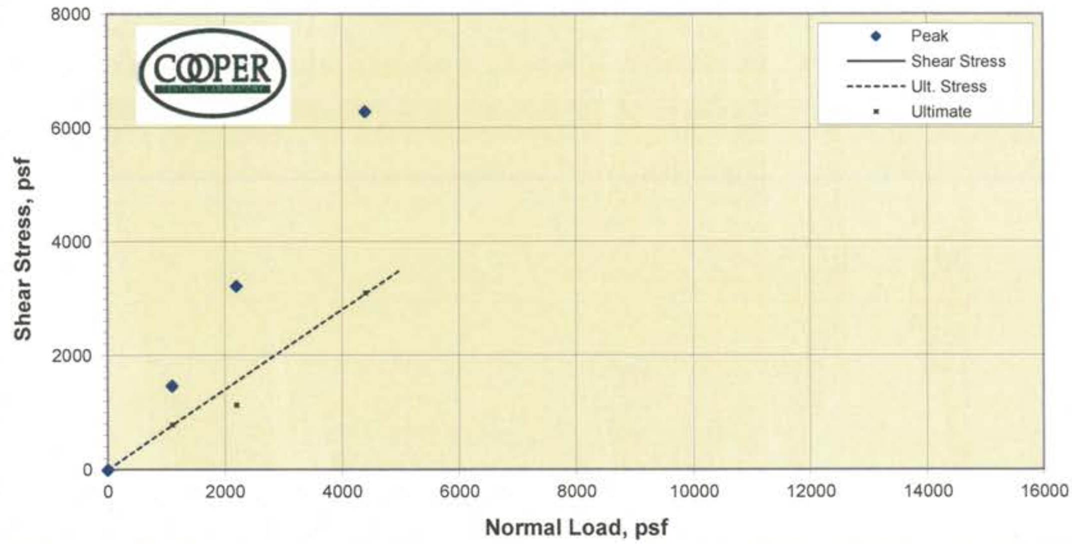
CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0008A	S15	71	Light Brown SAND
2	S0008A	S15	71	Light Brown SAND
3	S0008A	S15	71	Light Brown SAND
Remarks:	*DS-CU* A fully undrained condition may not be attained in this test.			

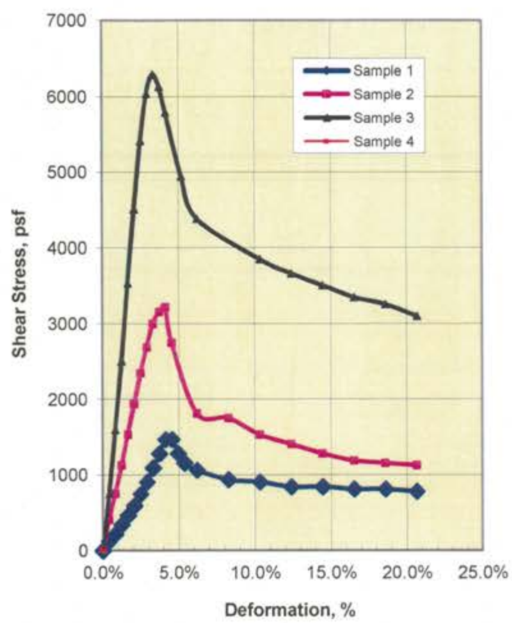
Plate No: B-6M

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	35.0
P. Cohesion (psf)		Ult. Cohesion (psf)	0



	Sample Data: Initial			
	1	2	3	4
Moisture %	14.3%	14.8%	15.1%	
Dry Dens., pcf	105.7	106.0	107.7	
Void Ratio	0.595	0.590	0.564	
Saturation %	64.8	67.9	72.5	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	18.8%	18.0%	17.1%	
Dry Dens., pcf	112.0	113.6	115.5	
Void Ratio	0.506	0.485	0.461	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.944	0.933	0.933	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	1471	3225	6293	
Strengths picked at	Peak	Peak	Peak	
Ult. Stress, psf	783	1127	3099	
Strain Rate, %/min.	1.0	1.0	1.0	

CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

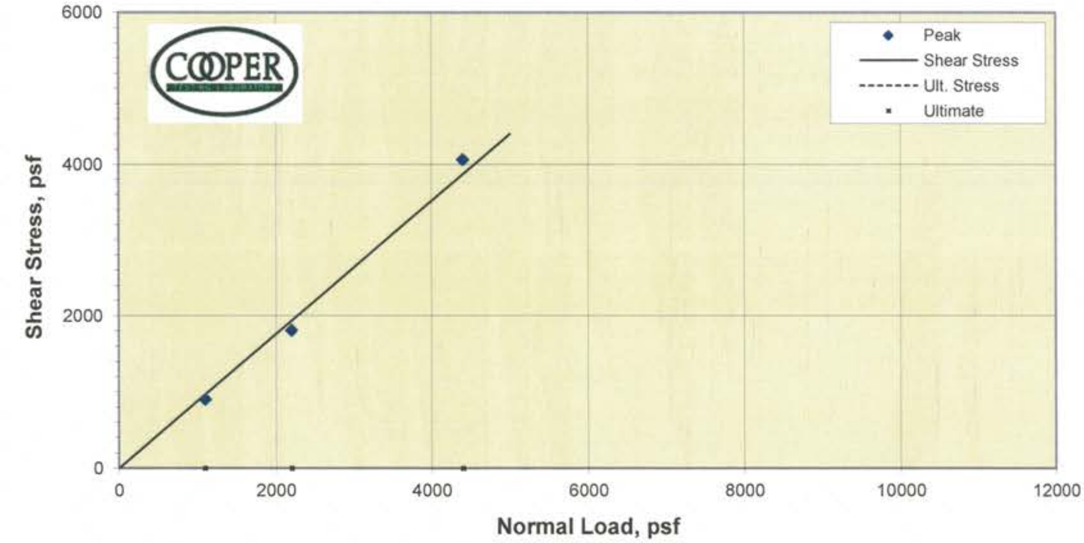
Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S0009R	16	76	Olive Brown Silty SAND
2	S0009R	16	76	Olive Brown Silty SAND
3	S0009R	16	76	Olive Brown Silty SAND

Remarks: The peak friction angle exceeded 45 degrees, possibly due to the angularity of the sand.
DS-CU A fully undrained condition may not be attained in this test.

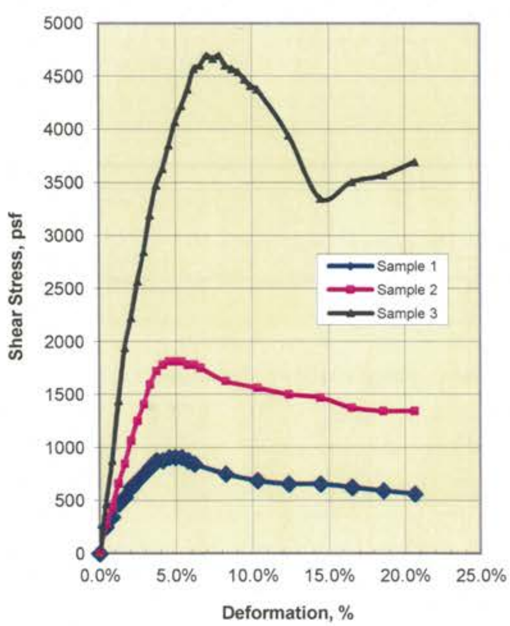
Plate No: B-6N

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	41.3	Ult. Phi (degrees)	
P. Cohesion (psf)	0	Ult. Cohesion (psf)	

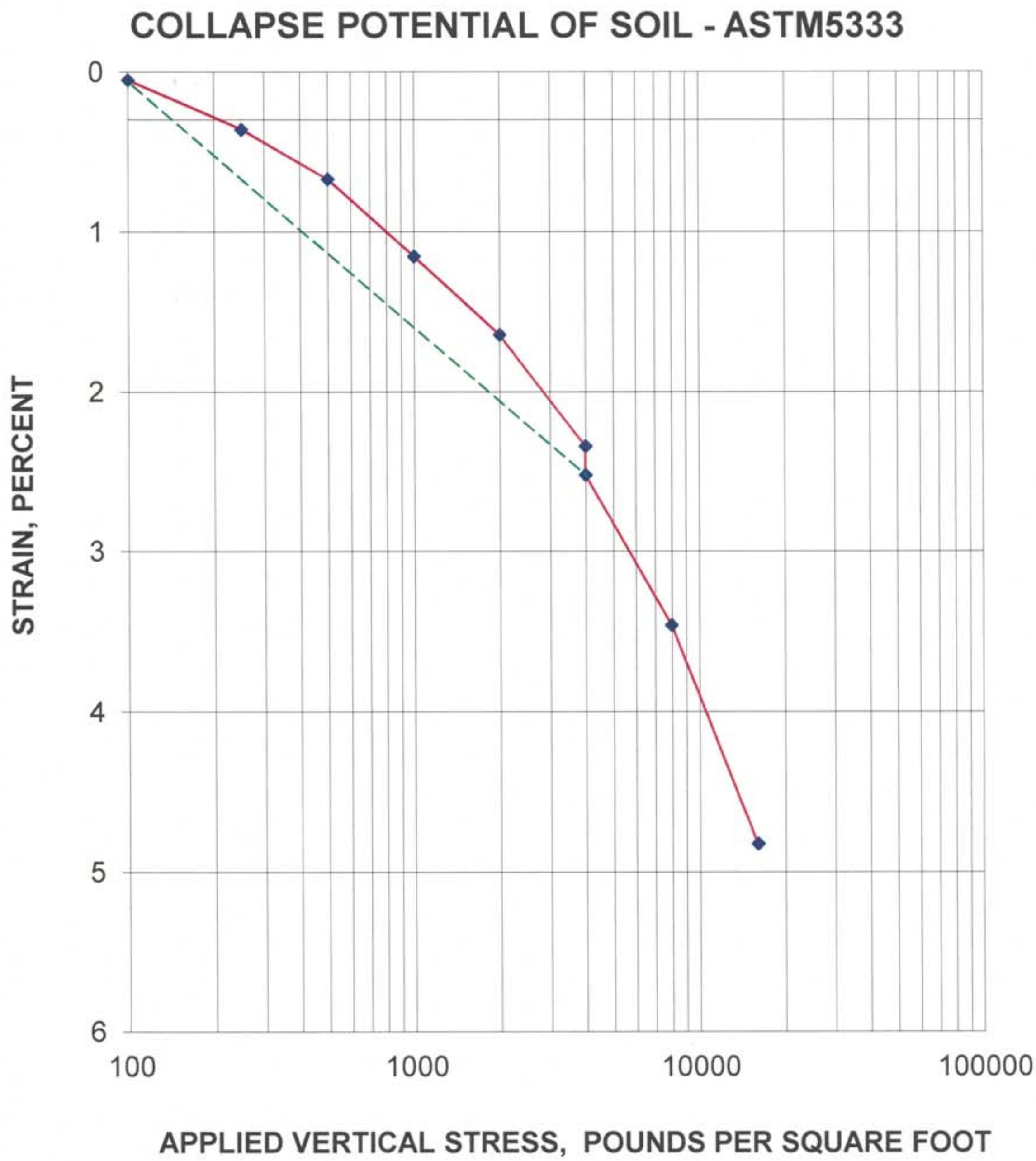


	Sample Data: Initial			
	1	2	3	4
Moisture %	3.3%	2.3%	3.1%	
Dry Dens., pcf	95.4	97.0	100.4	
Void Ratio	0.766	0.738	0.679	
Saturation %	11.5	8.5	12.4	
Diameter	2.42	2.42	2.42	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	20.3%	18.7%	16.1%	
Dry Dens., pcf	109.0	112.1	117.7	
Void Ratio	0.548	0.505	0.434	
Saturation %	100.0	100.0	100.0	
Diameter	2.42	2.42	2.42	
Height	0.876	0.865	0.853	
Normal Stress, psf	1100	2200	4400	
Shear Stress, psf	908	1816	4070	
Strengths picked at	5.0%	5.0%	5.0%	
Ult. Stress, psf				
Strain Rate, %/min.	1.0	1.0	1.0	

CTL #	157-298
Client:	Parikh Consultants, Inc.
Project	California High-Speed Train Project
Tested By:	MD
Reduced By:	JC
Date:	12/6/2011

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	S00010	4	16	Light Brown SAND
2	S00010	4	16	Light Brown SAND
3	S00010	4	16	Light Brown SAND
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

Plate No: B-60

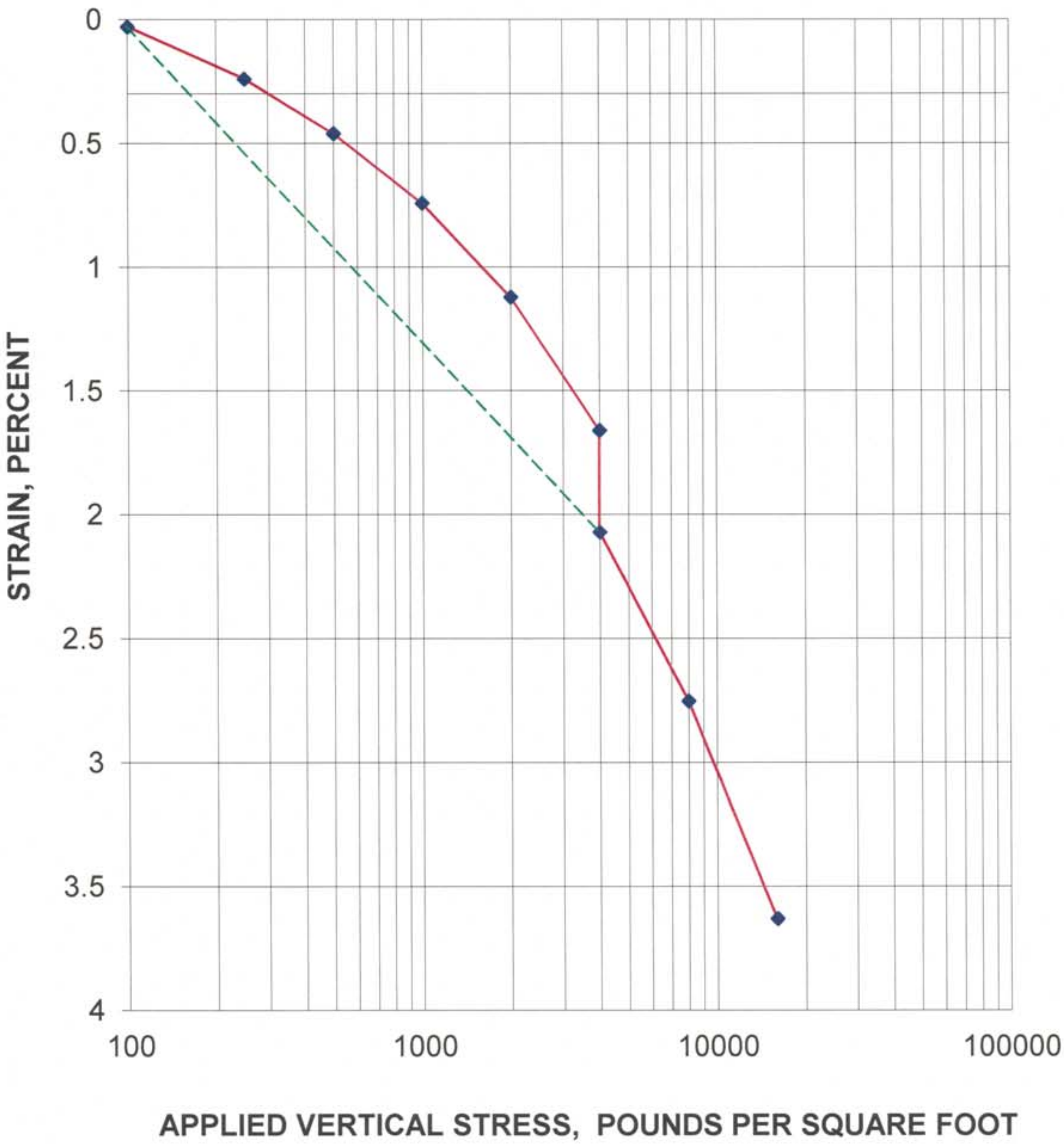


	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	14.0	107.5	1.0000	2.416
FINAL	18.1	112.9	0.9518	2.416

BORING NO.	S0001A	SAMPLE NO.	S15	ELEV. OR DEPTH	71'
DESCRIPTION	Silty fine Sand, brown (Undisturbed)				

PARIKH CONSULTANTS, INC. **GEOTECHNICAL CONSULTANTS** **MATERIALS ENGINEERING**	MINIMUM ARRA - FUNDED SEGMENT - CHST AECOM	
	DATE 12/2/2011	JOB NO: 2009-138-400
	Reported by: Prav Dayah	PLATE NO: B-7A

COLLAPSE POTENTIAL OF SOIL - ASTM5333



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	4.8	125.3	1.0000	2.416
FINAL	10.2	130.0	0.9637	2.416

BORING NO.	S0010A	SAMPLE NO.	S01	ELEV. OR DEPTH	3'
DESCRIPTION	Silty fine Sand, brown (Undisturbed)				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

MINIMUM ARRA - FUNDED SEGMENT - CHST AECOM	
DATE 12/8/2011	JOB NO: 2009-138-400
Reported by: Prav Dayah	PLATE NO: B-7B

LABORATORY TEST REPORT

(408)-452-9000
Parikh Consultants, Inc.

PROJECT NAME:	MINIMUM ARRA - FUNDED SEGMENT - CHST	PROJECT #:	2009-138-400
SAMPLE #:	S0002A DEPTH: 2'-5'	LAB #:	M837
SOURCE:	Fresno / Native	DATE:	12/2/2011
MATERIAL DESCRIPTION	Silty Fine Sand, brown		

EXPANSION INDEX - ASTM D-4829

Expansion Index		0		
Corrected Expansion Index		0		
Expansion Potential		Very Low		
Saturation %	Initial:	52	Final:	74
Moisture Contenet%	Initial:	7.1	Final:	10.0
Dry Density, pcf	Initial:	123.0	Final:	123.0

Specification

SAND EQUIVALENT CTM 217

		Specifications
SE		

Sieve Analysis CTM 202

Sieve Size	Percent Passing	Project Specification
6"		
3"		
1-1/2"		
1"		
3/4"		
3/8"		
No. 4		
No. 30		
No. 50		
No. 100		
No. 200		

Comments:

Reported by : Prav Dayah

PLATE NO: B-8A

LABORATORY TEST REPORT

(408)-452-9000
Parikh Consultants, Inc.

PROJECT NAME:	MINIMUM ARRA - FUNDED SEGMENT - CHST	PROJECT #:	2009-138-400
SAMPLE #:	S0008A DEPTH: 2'-5'	LAB #:	M837
SOURCE:	Fresno / Native	DATE:	12/2/2011
MATERIAL DESCRIPTION	Silty Fine Sand, brown		

EXPANSION INDEX - ASTM D-4829

					Specification
Expansion Index			0		
Corrected Expansion Index			0		
Expansion Potential			Very Low		
Saturation %	Initial:	51	Final:	82	
Moisture Contenet%	Initial:	7.1	Final:	11.5	
Dry Density, pcf	Initial:	122.2	Final:	122.2	

SAND EQUIVALENT CTM 217

		Specifications
SE		

Sieve Analysis CTM 202

Sieve Size	Percent Passing	Project Specification
6"		
3"		
1-1/2"		
1"		
3/4"		
3/8"		
No. 4		
No. 30		
No. 50		
No. 100		
No. 200		

Comments:

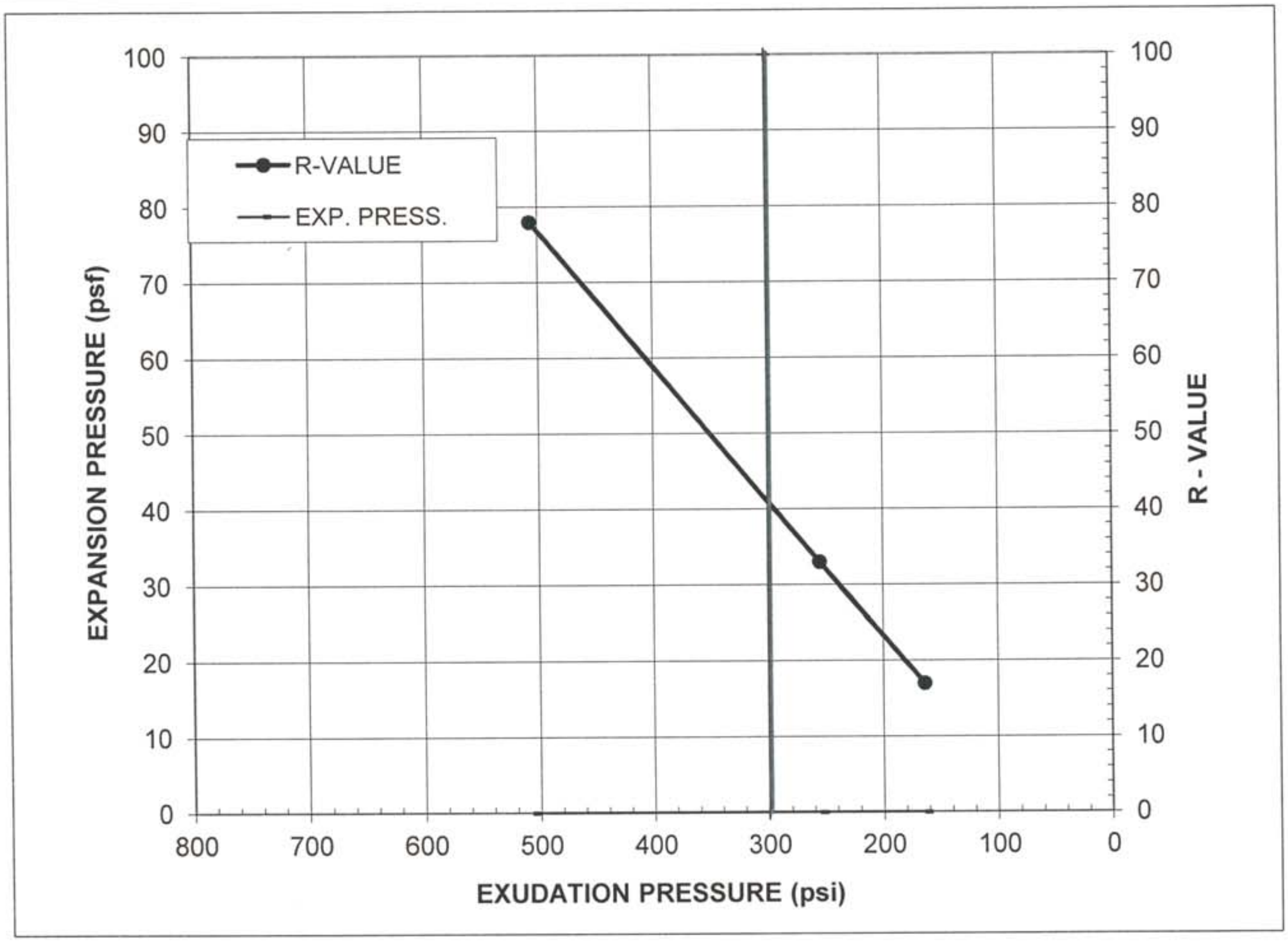
Reported by : Prav Dayah

PLATE NO: B-8B

R-VALUE REPORT

Parikh Consultants, Inc. ASTM D2844 or CTM 301 (408) 452-9000

Project Name:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/27/11
Client:	AECOM	Project #:	2009-138-400
Sample #:	S0001A Depth: 2'-5'	Lab #:	M837
Location / Source:	Fresno / Native	Sample Date:	
Material :	Silty Fine Sand, brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	164	255	507
Expansion Pressure, psf	0	0	0
R-Value	17	33	78
Moisture Content at Test, %	9.8	9.0	7.3
Dry Density at Test, pcf	126.4	128.4	130.6

R-Value @ 300 psi Exudation Pressure = 40

Expansion Pressure @300 psi Exudation, psf = 0

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

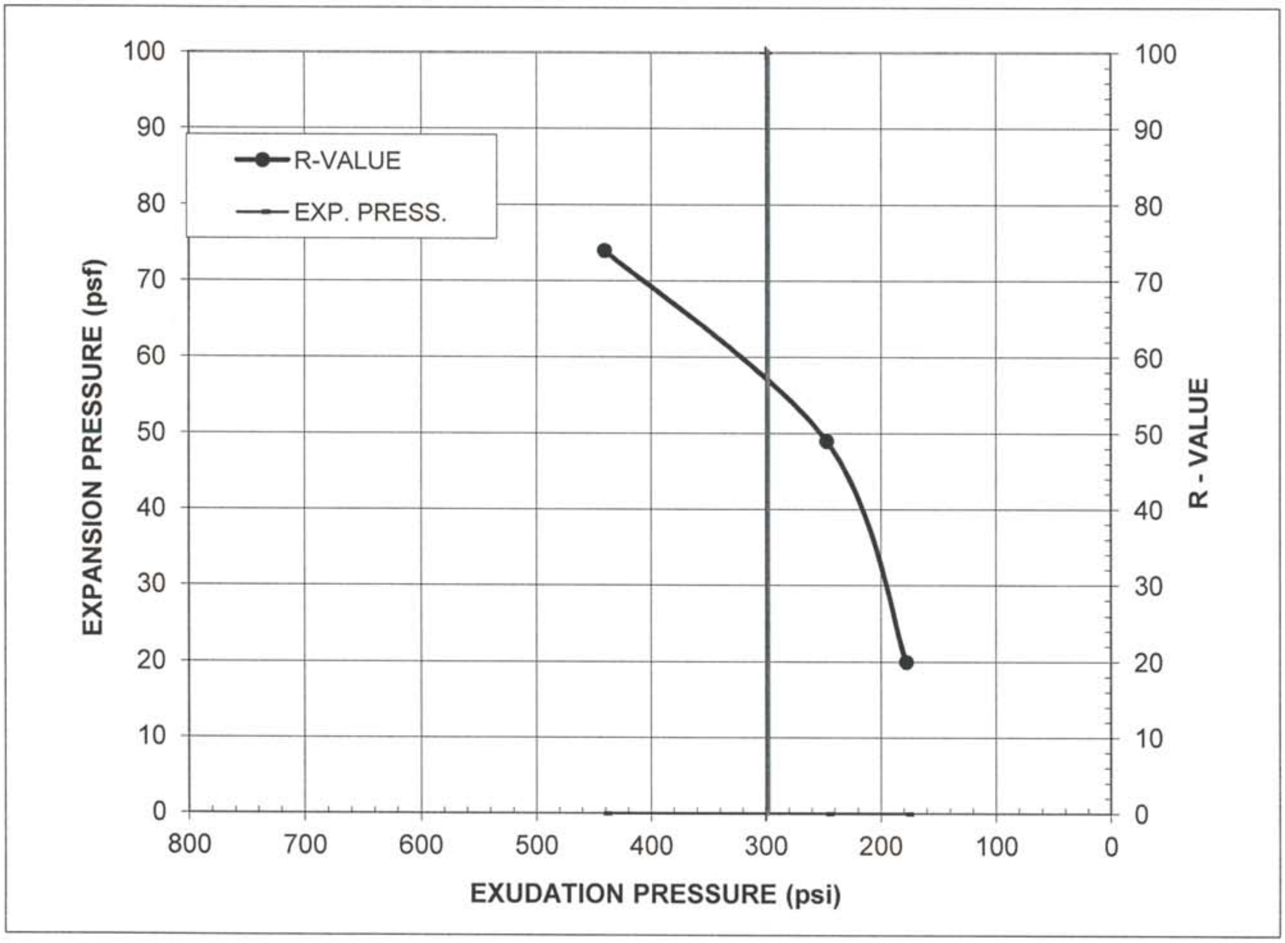
PLATE NO: B-9A

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. ASTM D2844 or CTM 301 (408) 452-9000

Project Name:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/27/11
Client:	AECOM	Project #:	2009-138-400
Sample #:	S0005R Depth: 2'-5'	Lab #:	M837
Location / Source:	Fresno / Native	Sample Date:	
Material :	Silty Fine Sand, brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	178	247	441
Expansion Pressure, psf	0	0	0
R-Value	20	49	74
Moisture Content at Test, %	11.3	10.4	9.5
Dry Density at Test, pcf	121.2	123.0	124.5

R-Value @ 300 psi Exudation Pressure = 57

Expansion Pressure @300 psi Exudation, psf = 0

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

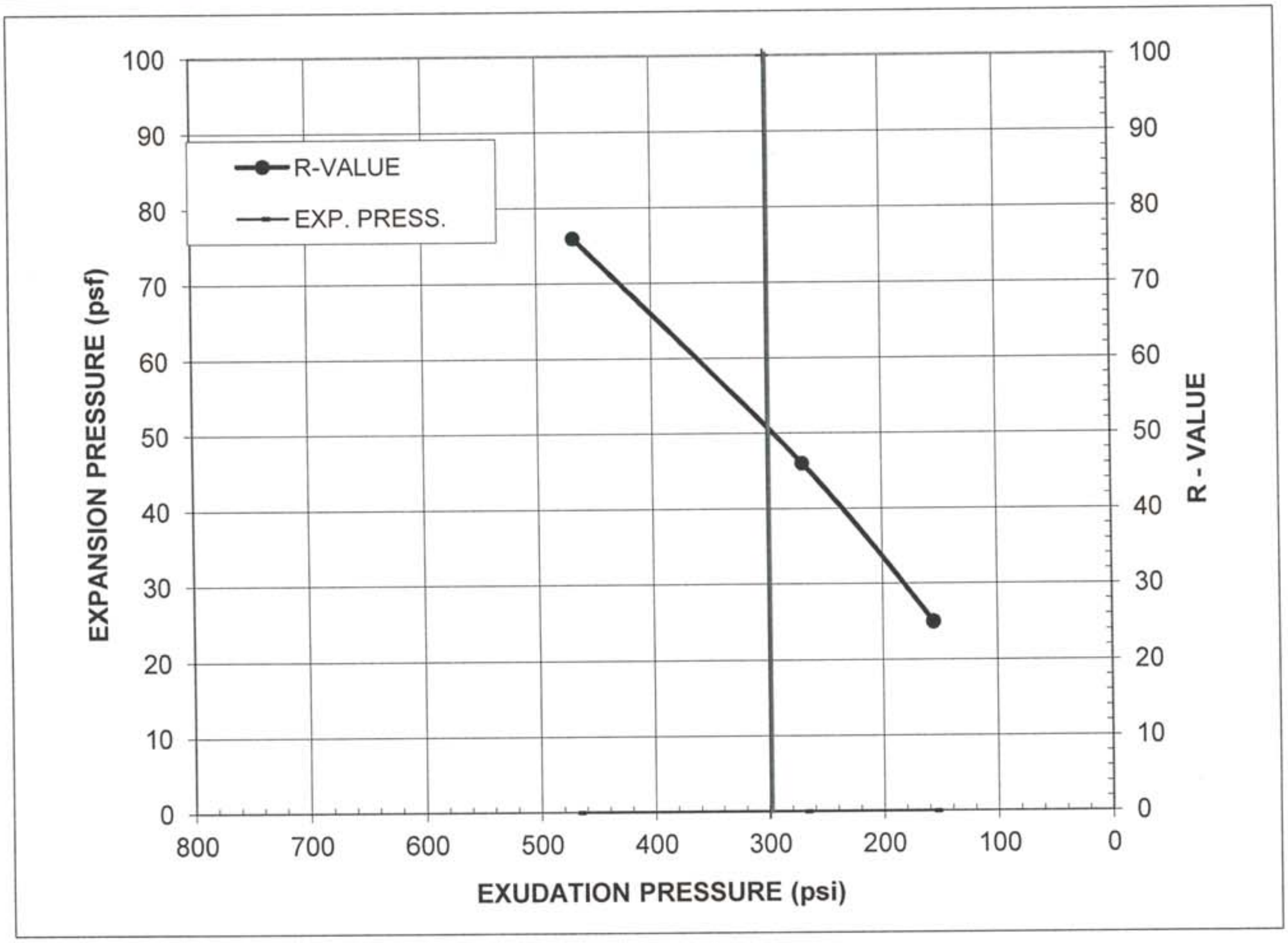
PLATE NO: B-9B

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. ASTM D2844 or CTM 301 (408) 452-9000

Project Name: MINIMUM ARRA - FUNDED SEGMENT - CHST		Date:	11/27/11
Client: AECOM		Project #:	2009-138-400
Sample #: S0006A	Depth: 2'-5'	Lab #:	M837
Location / Source:	Fresno / Native	Sample Date:	
Material : Silty Fine Sand, brown		Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	156	269	468
Expansion Pressure, psf	0	0	0
R-Value	25	46	76
Moisture Content at Test, %	10.0	8.7	7.8
Dry Density at Test, pcf	124.6	127.4	128.6

R-Value @ 300 psi Exudation Pressure = 50

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

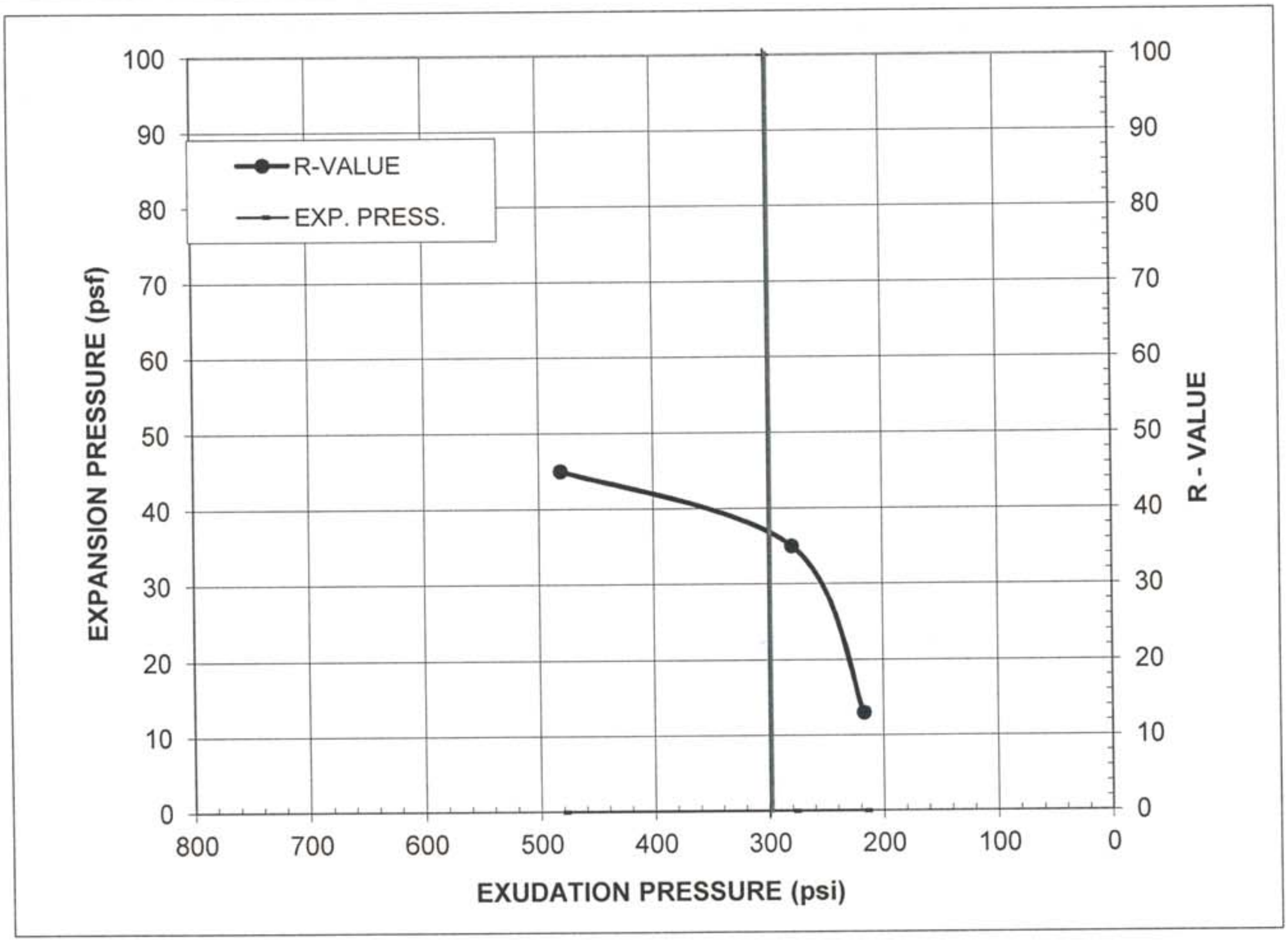
PLATE NO: B-9C

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. ASTM D2844 or CTM 301 (408) 452-9000

Project Name:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/27/11
Client:	AECOM	Project #:	2009-138-400
Sample #:	S0008A Depth: 2'-5'	Lab #:	M837
Location / Source:	Fresno / Native	Sample Date:	
Material :	Silty Fine Sand, brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	217	279	481
Expansion Pressure, psf	0	0	0
R-Value	13	35	45
Moisture Content at Test, %	10.5	9.6	8.8
Dry Density at Test, pcf	122.9	123.3	129.3

R-Value @ 300 psi Exudation Pressure = 37

Expansion Pressure @300 psi Exudation, psf = 0

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

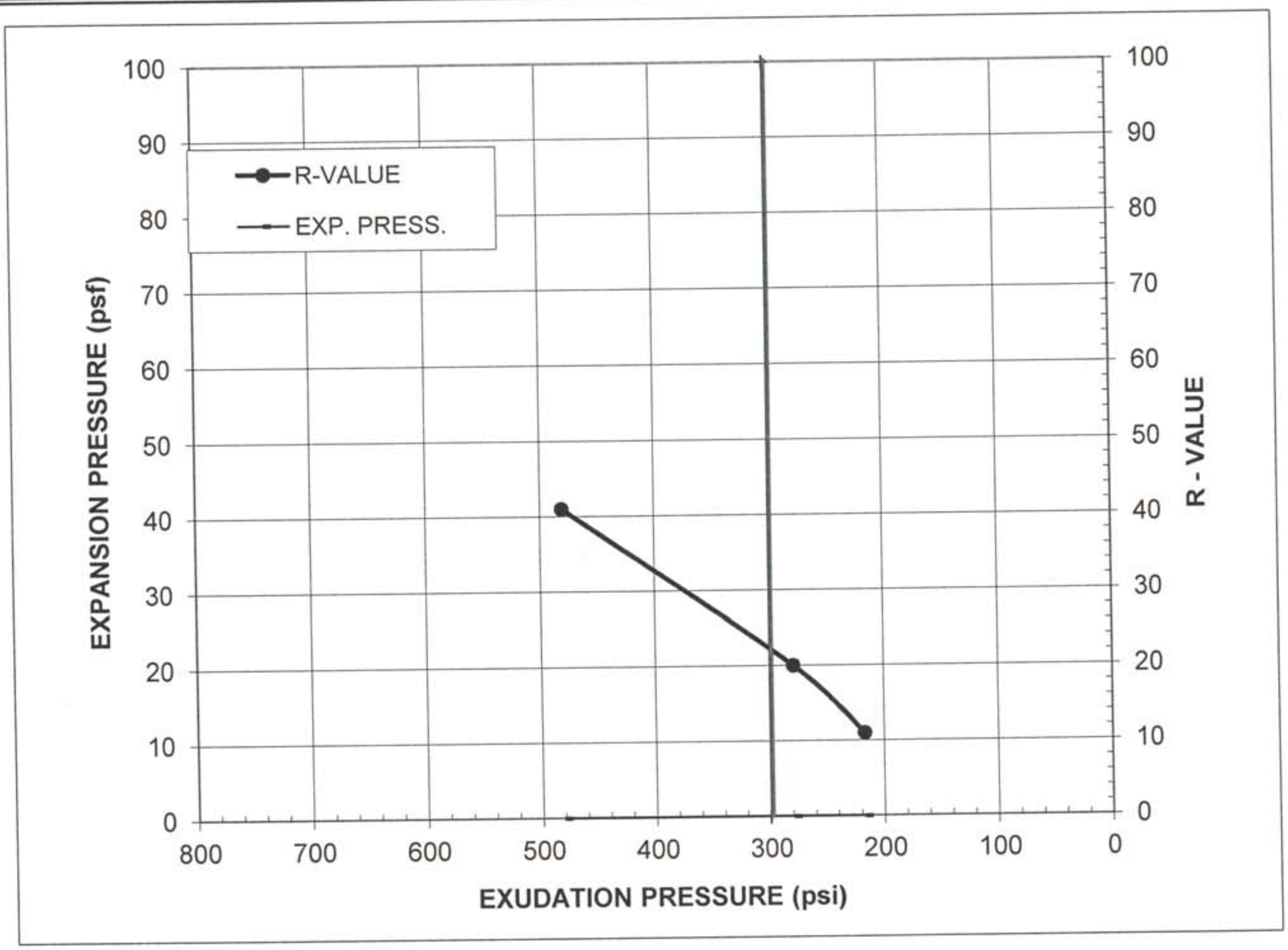
PLATE NO: B-9D

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 452-9000

Project Name:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/27/11
Client:	AECOM	Project #:	2009-138-400
Sample #:	S0009R Depth: 2'-5'	Lab #:	M837
Location / Source:	Fresno / Native	Sample Date:	
Material :	Silty Fine Sand, brown	Sampled By:	



Specimen No.	150	261	432
Exudation Pressure, psi	217	279	481
Expansion Pressure, psf	0	0	0
R-Value	11	20	41
Moisture Content at Test, %	8.3	7.4	6.6
Dry Density at Test, pcf	128.3	130.9	133.3

R-Value @ 300 psi Exudation Pressure = 22

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

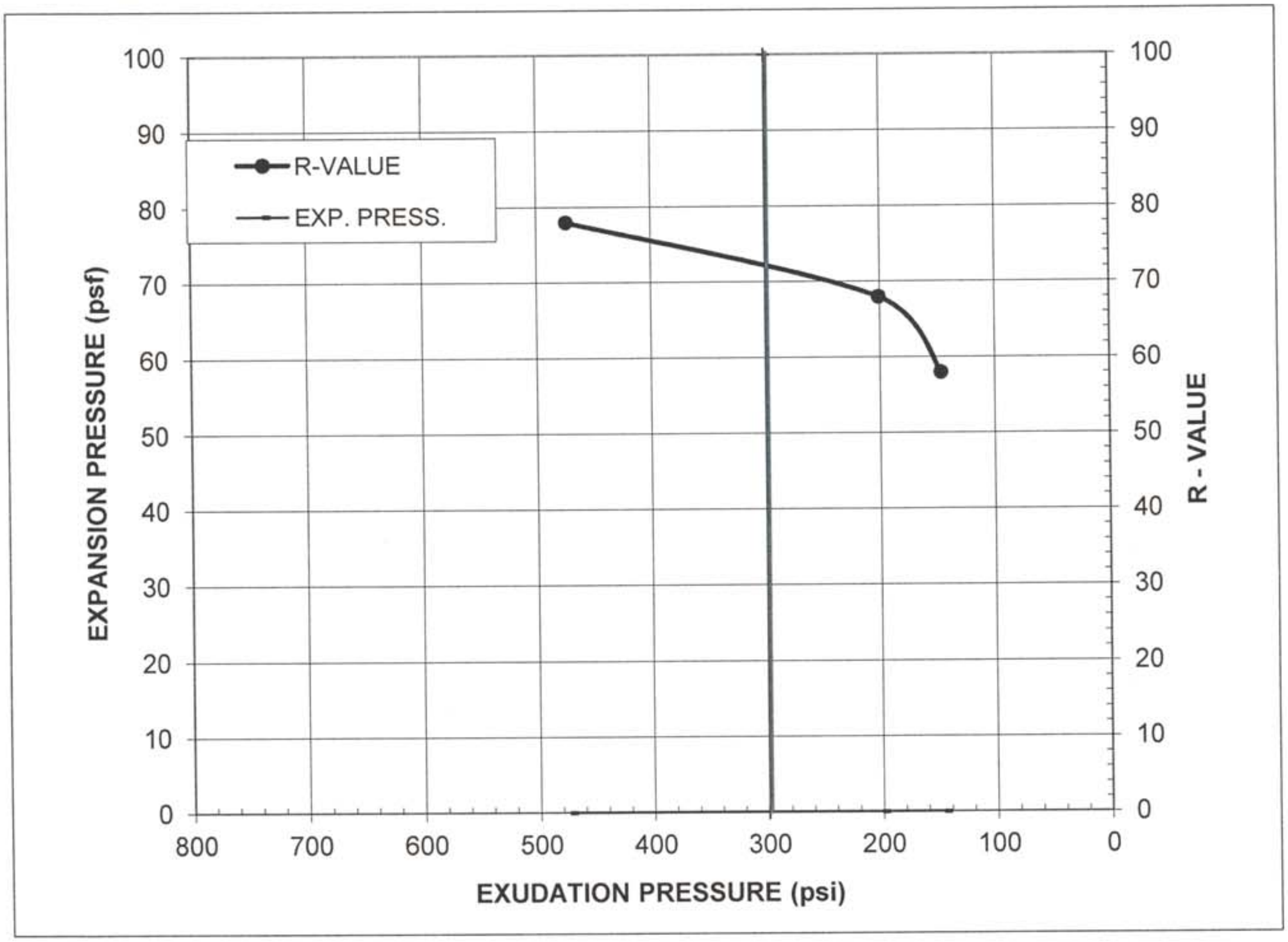
PLATE NO: B-9E

RVALUE with calcs pdp

R-VALUE REPORT

Parikh Consultants, Inc. — ASTM D2844 or CTM 301 — (408) 452-9000

Project Name: MINIMUM ARRA - FUNDED SEGMENT - CHST		Date:	11/27/11
Client: AECOM		Project #:	2009-138-400
Sample #: S0010A	Depth: 2'-5'	Lab #:	M837
Location / Source:	Fresno / Native	Sample Date:	
Material : Silty Fine Sand, brown		Sampled By:	



Specimen No.	150	261	432
Exudation Pressure, psi	147	201	474
Expansion Pressure, psf	0	0	0
R-Value	58	68	78
Moisture Content at Test, %	11.6	11.2	10.7
Dry Density at Test, pcf	123.3	124.6	124.9

R-Value @ 300 psi Exudation Pressure = 72

Expansion Pressure @300 psi Exudation, psf = 0

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

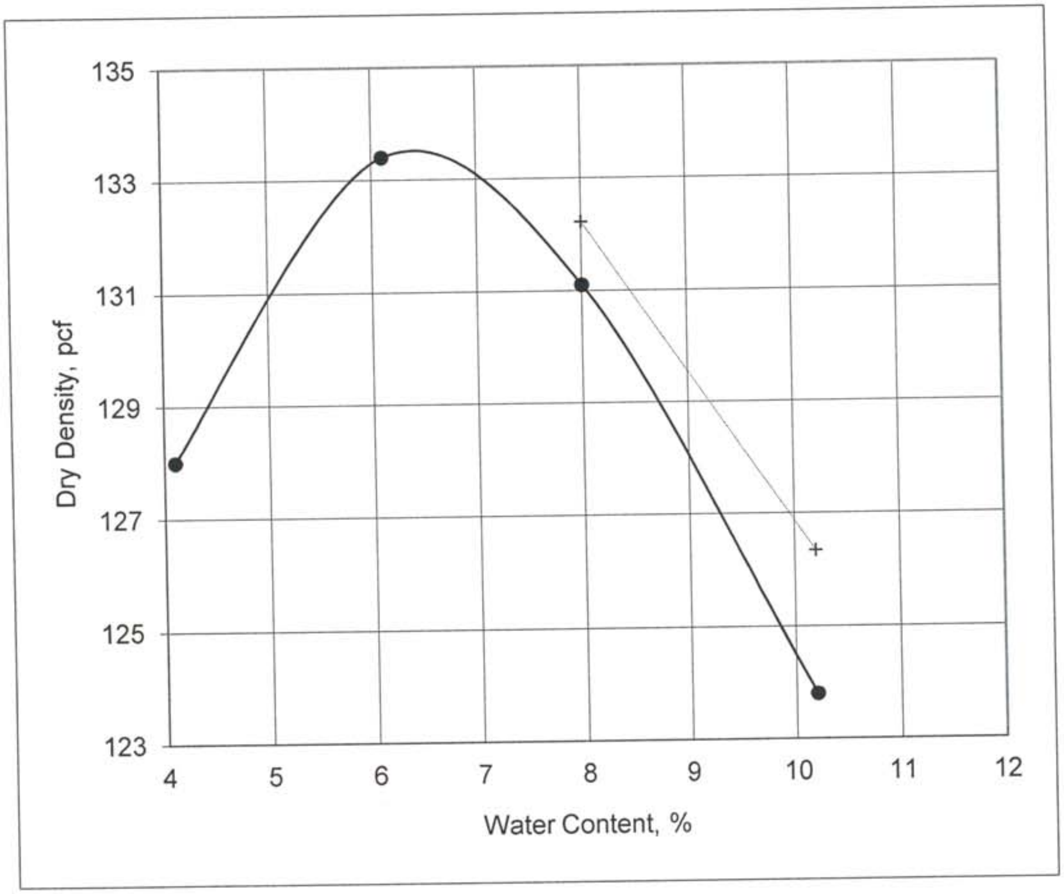
PLATE NO: B-9F

RVALUE with calcs pdp

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/23/11
Client:	AECOM	Project #:	210126.10
Sample #:	S0001A Depth: 2'-5'	Lab #:	M837
Location/Source:	Fresno / Native	Sample Date:	
Material:	Silty Fine Sand, brown	Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.55

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	4.1	6.1	8.0	10.2
Dry Density, pcf	128.0	133.4	131.1	123.8

MAXIMUM DRY DENSITY, pcf: **133.3**	OPTIMUM MOISTURE, %: **6.5**

Comments:

Report By: Prav D Dayah

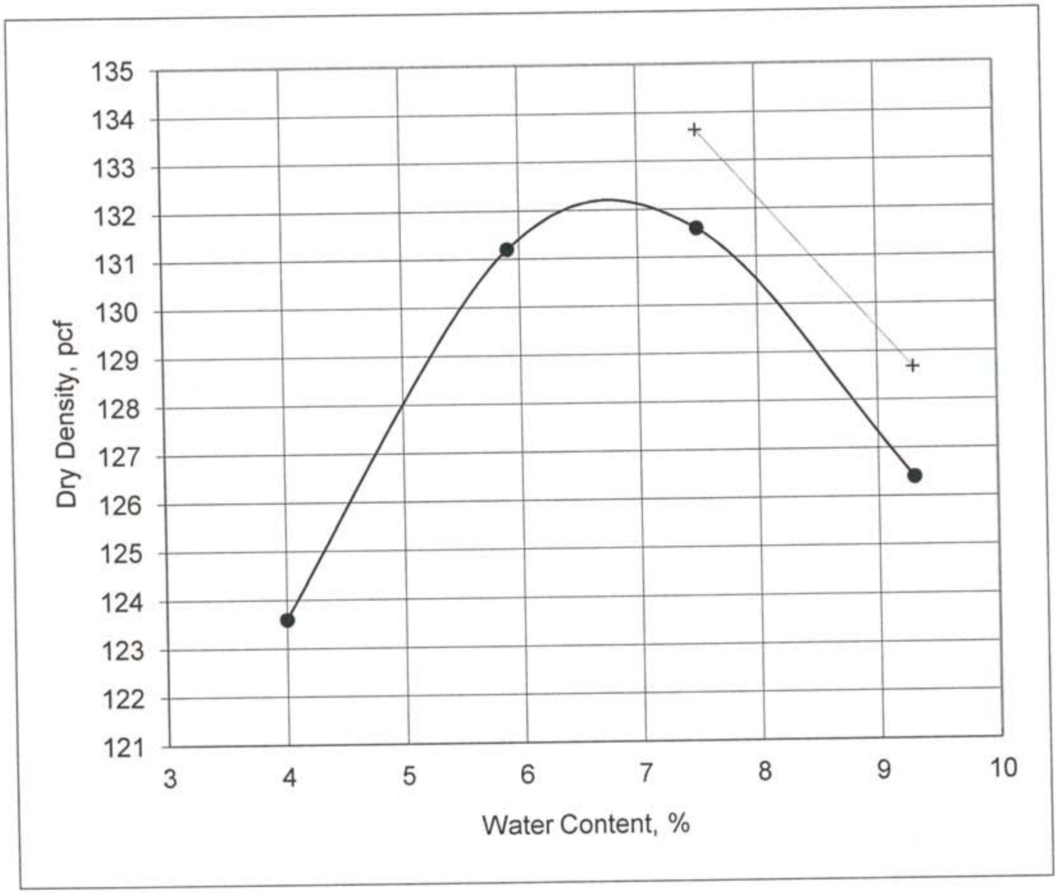
PLATE NO: B-10A

R340 rev. 10/08/96

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/23/2011
Client:	AECOM	Project #:	210126.10
Sample #:	S0002A Depth: 2'-5'	Lab #:	M837
Location/Source:	Fresno / Native	Sample Date:	
Material:	Silty Fine Sand, brown	Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.55

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	4.0	5.9	7.5	9.3
Dry Density, pcf	123.6	131.2	131.6	126.4

MAXIMUM DRY DENSITY, pcf: **132.2**	OPTIMUM MOISTURE, %: **6.8**

Comments:

Report By: Prav D Dayah

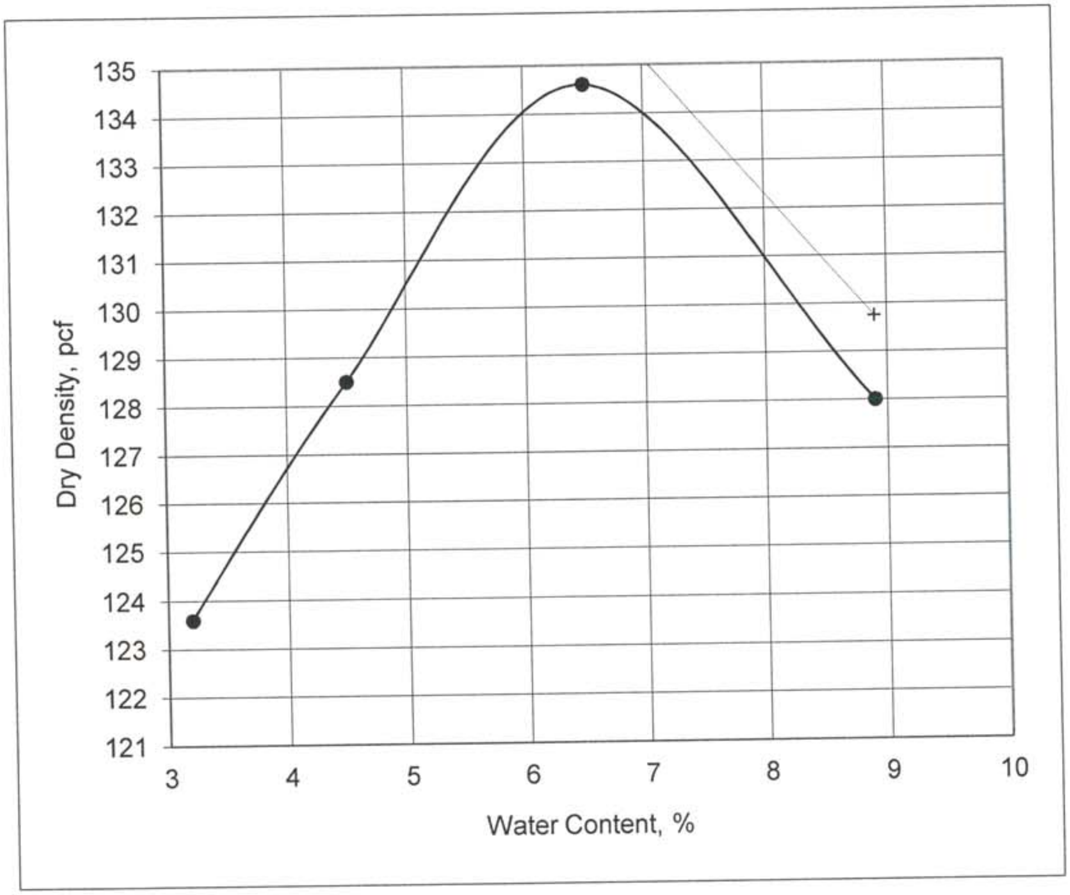
PLATE NO: B-10B

R340 rev. 10/08/96

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/23/2011
Client:	AECOM	Project #:	210126.10
Sample #:	S0003A Depth: 2'-5'	Lab #:	M837
Location/Source:	Fresno / Native	Sample Date:	
Material:	Silty Fine Sand, brown	Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.55

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	3.2	4.5	6.5	8.9
Dry Density, pcf	123.6	128.5	134.6	128.0

MAXIMUM DRY DENSITY, pcf: **134.5**	OPTIMUM MOISTURE, %: **6.5**

Comments:

Report By: Prav D Dayah

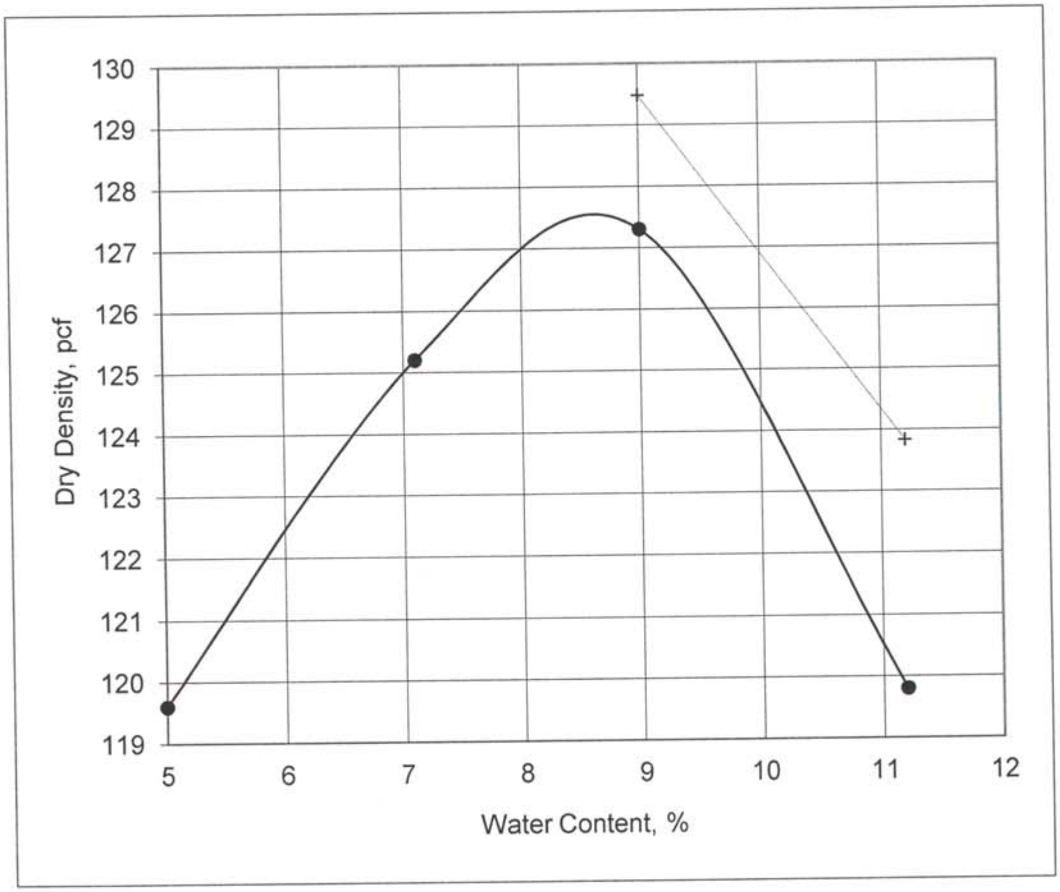
PLATE NO: B-10C

R340 rev. 10/08/96

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/23/2011
Client:	AECOM	Project #:	210126.10
Sample #:	S0005R Depth: 2'-5'	Lab #:	M837
Location/Source:	Fresno / Native	Sample Date:	
Material:	Silty Fine Sand, brown	Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.55

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	5.0	7.1	9.0	11.2
Dry Density, pcf	119.6	125.2	127.3	119.8

MAXIMUM DRY DENSITY, pcf: **127.5**	OPTIMUM MOISTURE, %: **8.6**

Comments:

Report By: Prav D Dayah

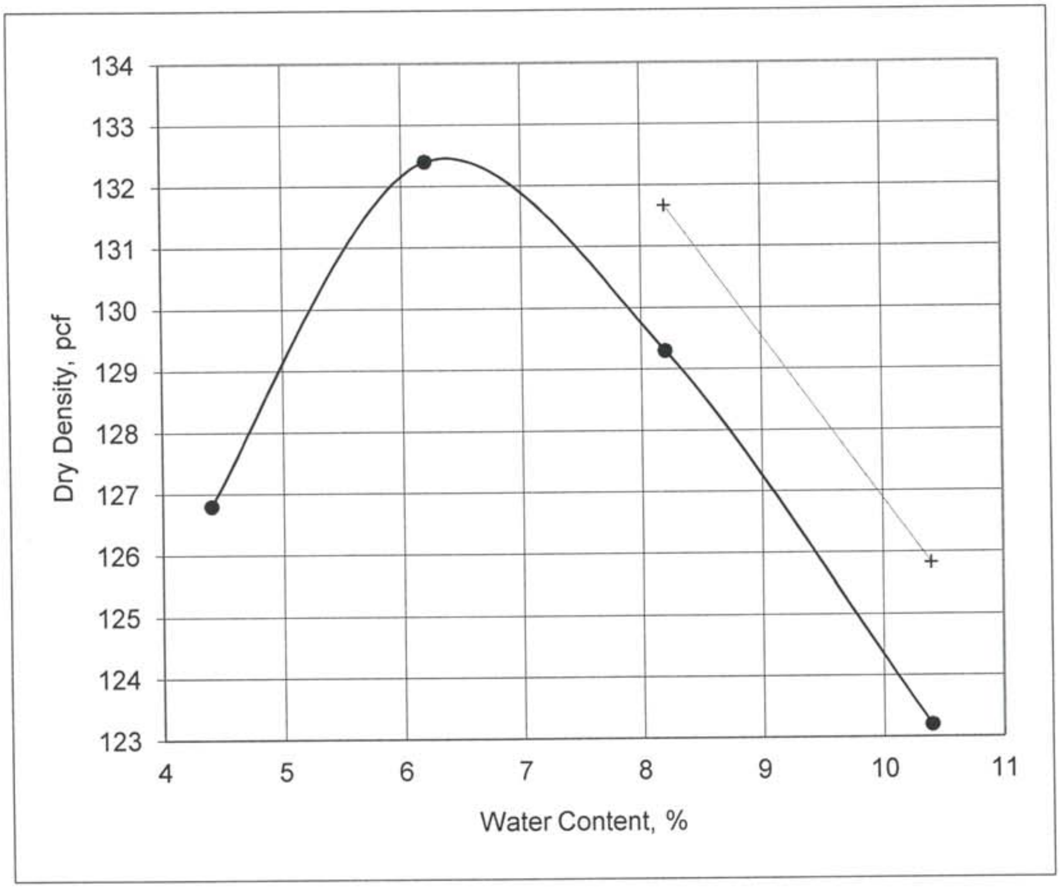
PLATE NO: B-10D

R340 rev. 10/08/96

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	12/26/2011
Client:	AECOM	Project #:	210126.10
Sample #:	S0006A Depth: 2'-5'	Lab #:	M837
Location/Source:	Fresno / Native	Sample Date:	
Material:	Silty Fine Sand, brown	Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.55

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	4.4	6.2	8.2	10.4
Dry Density, pcf	126.8	132.4	129.3	123.2

MAXIMUM DRY DENSITY, pcf: **132.5**	OPTIMUM MOISTURE, %: **6.4**

Comments:

Report By: Prav D Dayah

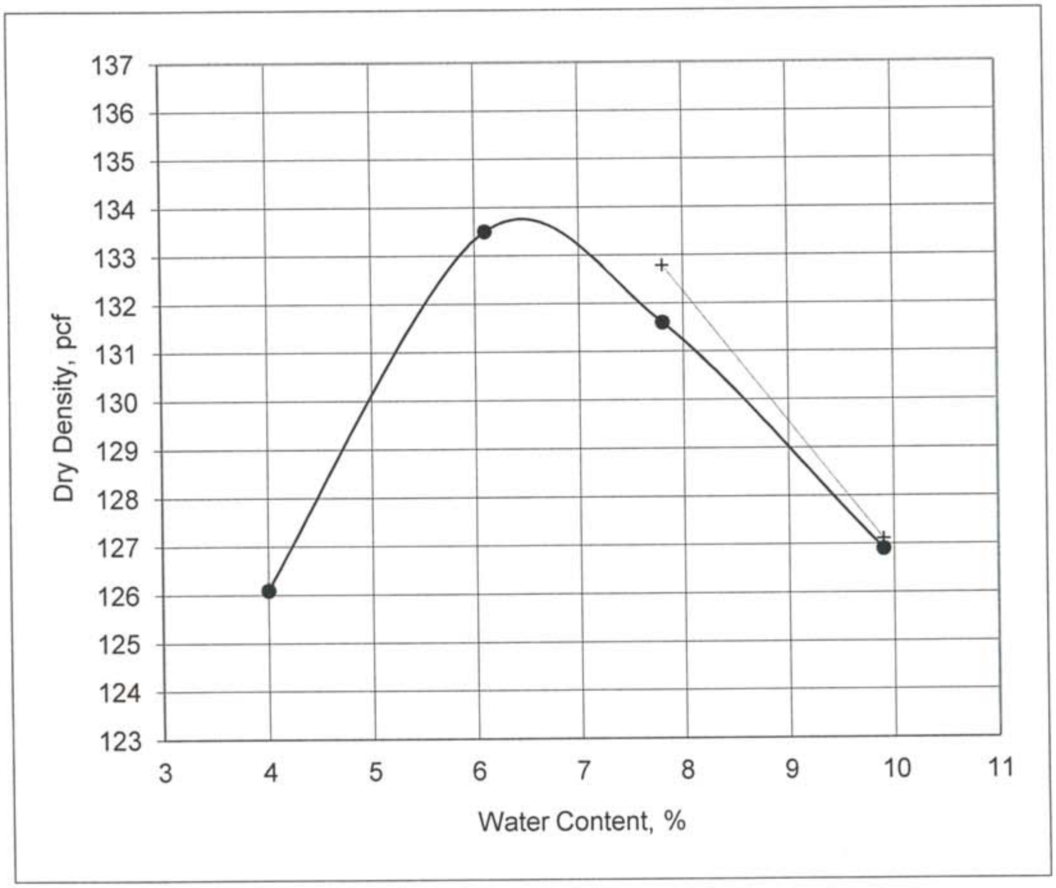
PLATE NO: B-10E

R340 rev. 10/08/96

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/26/2011
Client:	AECOM	Project #:	210126.10
Sample #:	S0008A Depth: 2'-5'	Lab #:	M837
Location/Source:	Fresno / Native	Sample Date:	
Material:	Silty Fine Sand, brown	Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.55

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	4.0	6.1	7.8	9.9
Dry Density, pcf	126.1	133.5	131.6	126.9

MAXIMUM DRY DENSITY, pcf: **133.7**	OPTIMUM MOISTURE, %: **6.5**

Comments:

Report By: Prav D Dayah

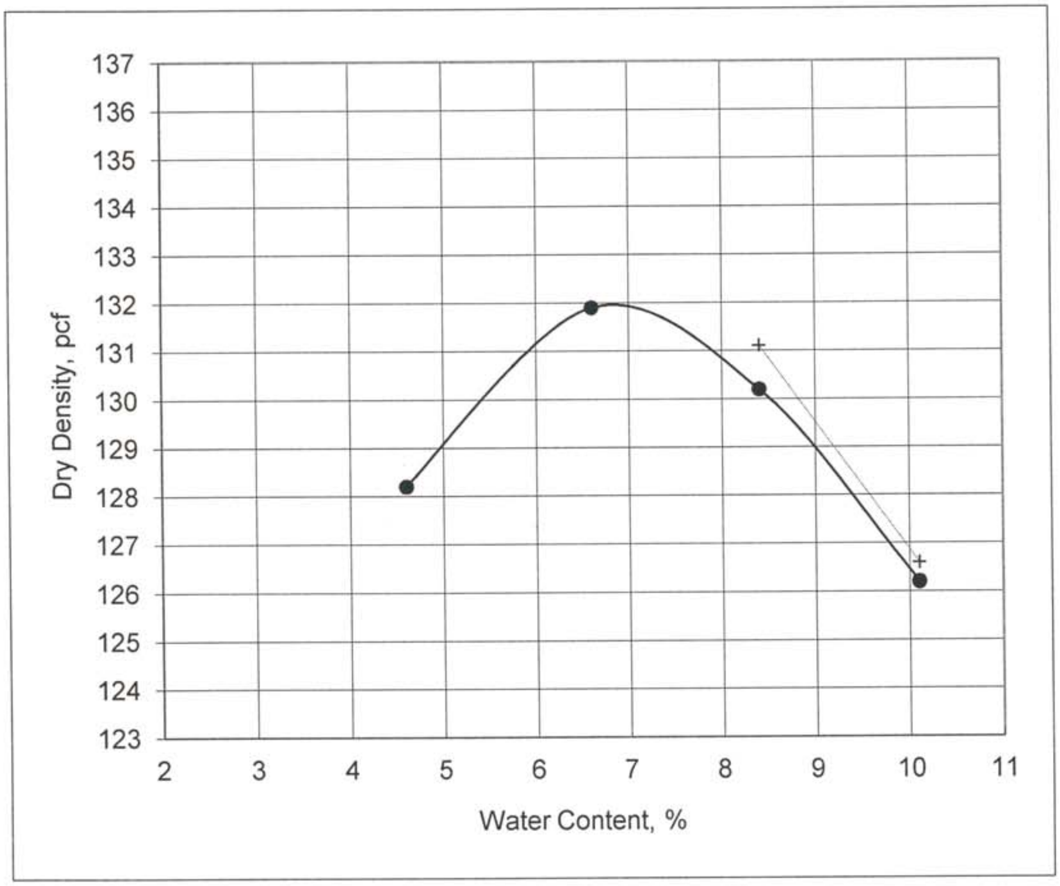
PLATE NO: B-10F

R340 rev. 10/08/96

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/27/11
Client:	AECOM	Project #:	210126.10
Sample #:	S0009A Depth: 2'-5'	Lab #:	M837
Location/Source:	Fresno / Native	Sample Date:	
Material:	Silty Fine Sand, brown	Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.55

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	4.6	6.6	8.4	10.1
Dry Density, pcf	128.2	131.9	130.2	126.2

MAXIMUM DRY DENSITY, pcf: **132.0**	OPTIMUM MOISTURE, %: **6.8**

Comments:

Report By: Prav D Dayah

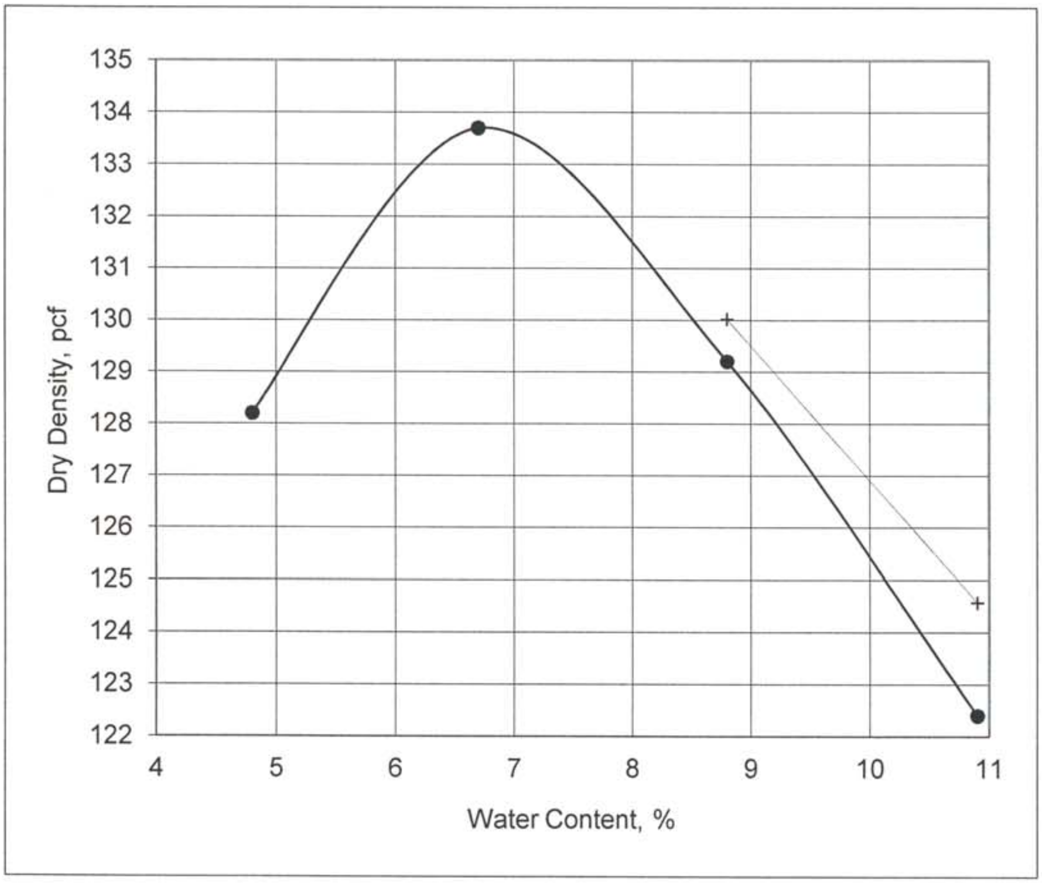
PLATE NO: B-10G

R340 rev. 10/08/96

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST			Date:	11/27/11
Client:	AECOM			Project #:	210126.10
Sample #:	S0010A	Depth:	2'-5'	Lab #:	M837
Location/Source:	Fresno / Native			Sample Date:	
Material:	Silty Fine Sand, brown			Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.55

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	4.8	6.7	8.8	10.9
Dry Density, pcf	128.2	133.7	129.2	122.4

MAXIMUM DRY DENSITY, pcf: **133.8**	OPTIMUM MOISTURE, %: **6.8**

Comments:

Report By: Prav D Dayah

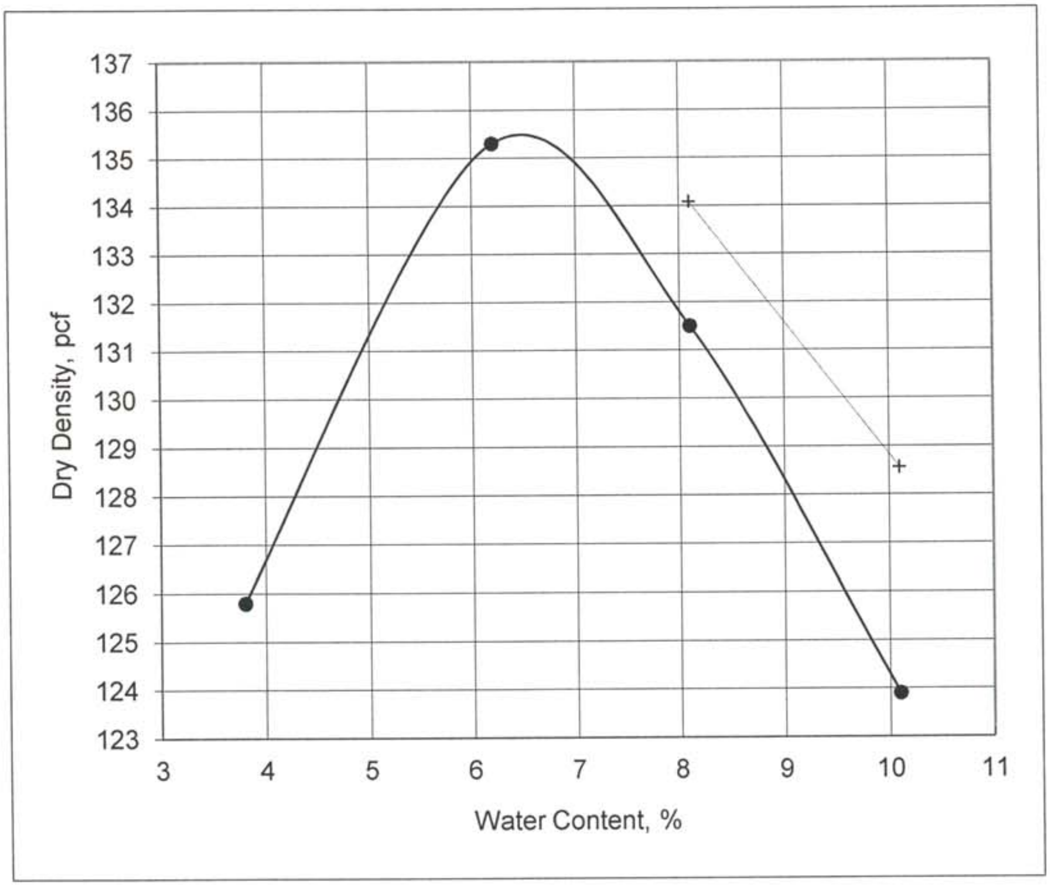
PLATE NO: B-10H

R340 rev. 10/08/96

LABORATORY COMPACTION REPORT

(408)-452-9000
Parikh Consultants Inc.

Project:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Date:	11/27/11
Client:	AECOM	Project #:	210126.10
Sample #:	S0007A Depth: 2'-5'	Lab #:	M837
Location/Source:	Fresno / Native	Sample Date:	
Material:	Silty Fine Sand, brown	Sampled By:	



ASTM Test Designation: [ ] D 698 [X] D 1557 Method: [X] A [ ] B [ ] C

100 % Saturation Curve-Estimated Specific Gravity: 2.60

Laboratory Test Results

Trial #	1	2	3	4
Water Content,%	3.8	6.2	8.1	10.1
Dry Density, pcf	125.8	135.3	131.5	123.9

MAXIMUM DRY DENSITY, pcf: **135.5**	OPTIMUM MOISTURE, %: **6.5**

Comments:

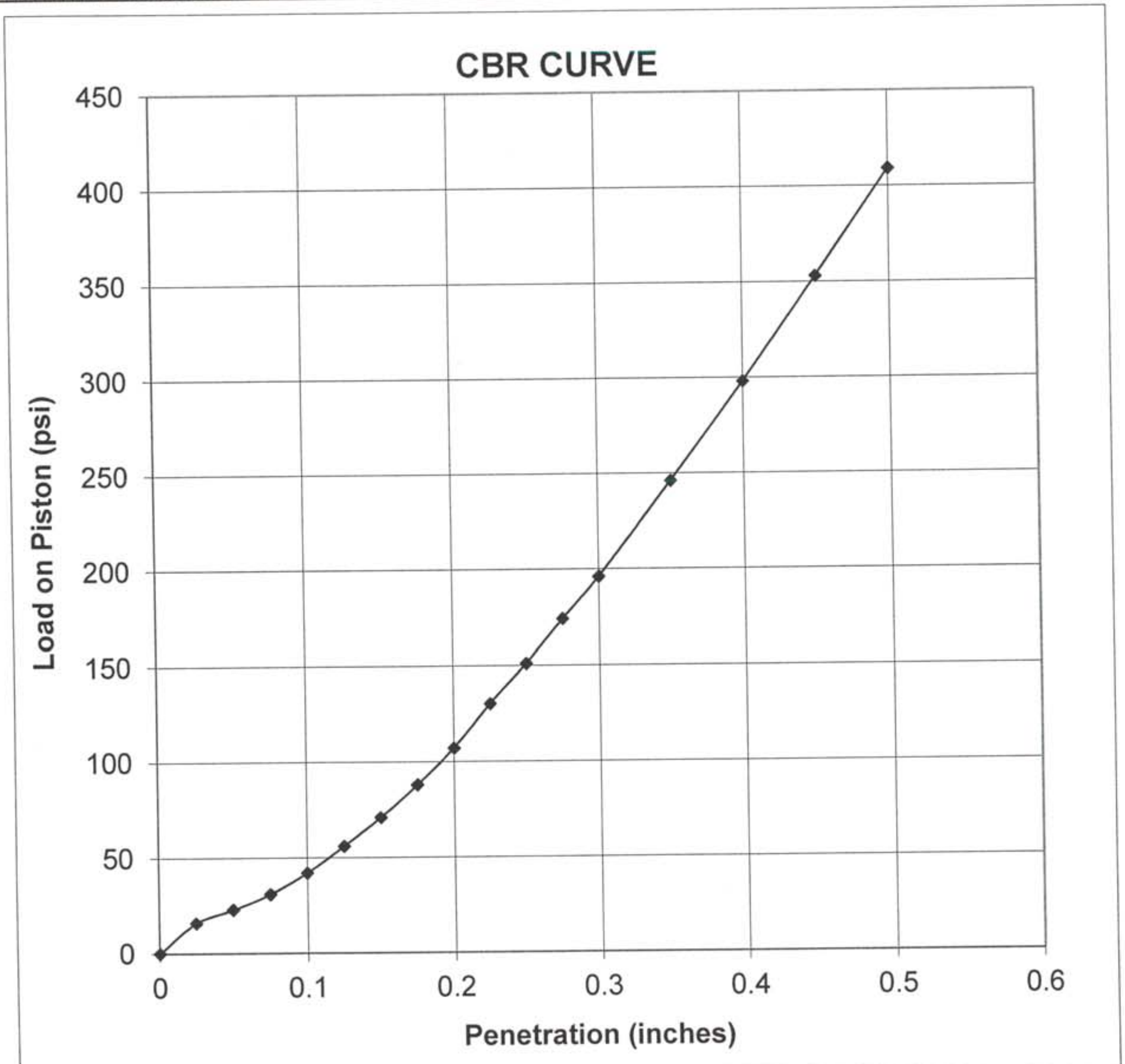
Report By: Prav D Dayah

PLATE NO: B-10I

R340 rev. 10/08/96

CALIFORNIA BEARING RATIO
ASTM D1883

Project Name:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Project #:	2009-138-400
Sample #:	S0002A Depth: 2'-5'	Lab #:	M837
Mat'l Description:	Silty Sand, brown	Date	12/7/2011
% Quick Lime (SS Lime):	None	Tested By:	PDD



Method of Preparation D1557 - Soaked

Max. dry density (pcf) **132.2**
Opt. % m/c **6.8**

Before Soak	
Dry Density (pcf)	127.4
% m/c before compaction	9.0
% m/c after compaction	8.8

After Soak	
Dry Density (pcf)	127.5
% m/c top 1"	9.1
Average	9.1

CBR VALUE	
.100"	4.2
.200"	7.1

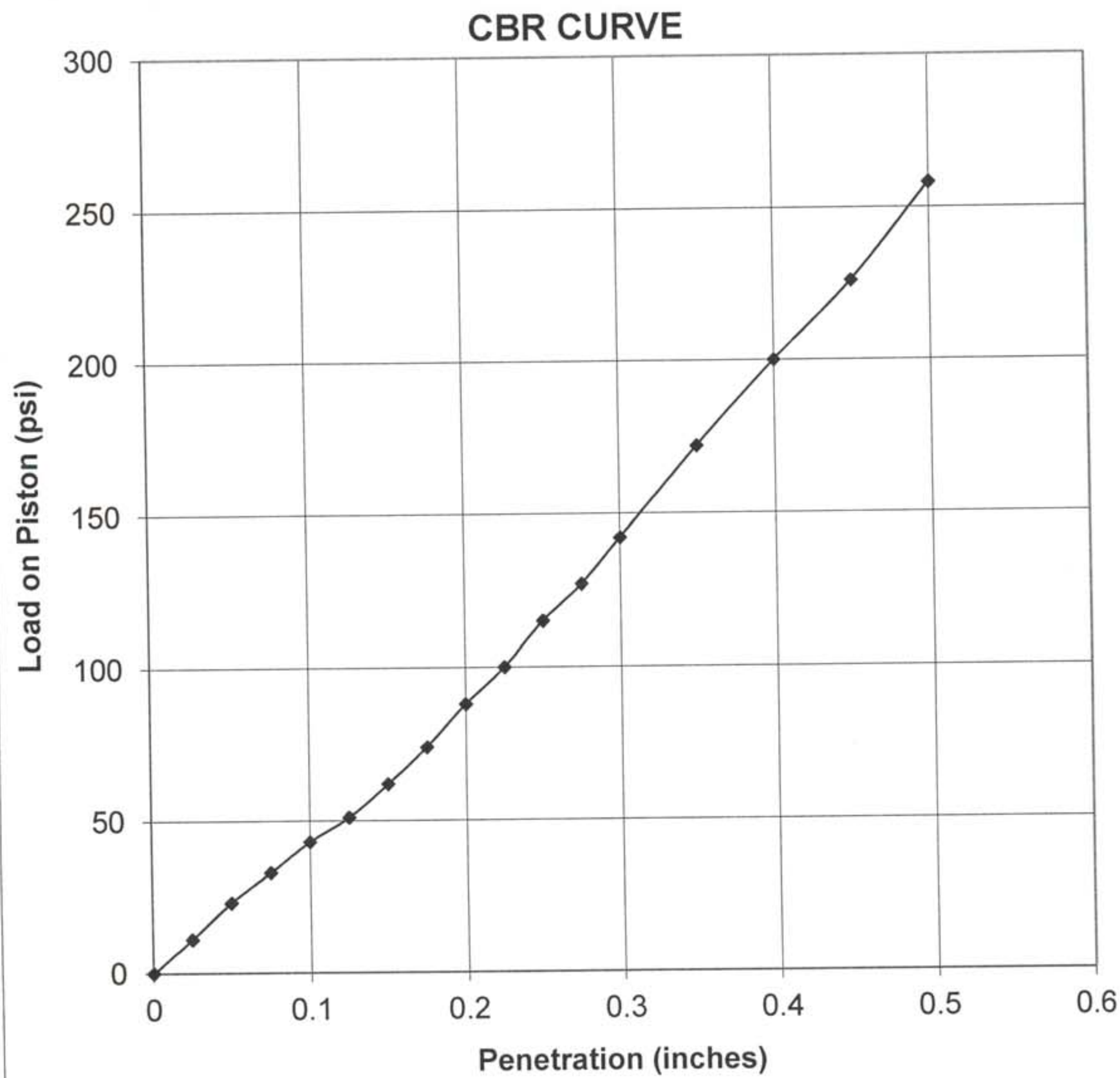
Swell % 0.0 Surcharge Wt.(lbs) 10

PLATE NO: B-11A

PARIKH CONSULTANTS, INC.

CALIFORNIA BEARING RATIO
ASTM D1883

Project Name:	MINIMUM ARRA - FUNDED SEGMENT - CHST	Project #:	2009-138-400
Sample #:	S0005R Depth: 2'-5'	Lab #:	M837
Mat'l Description:	Silty Sand, brown	Date	12/7/2011
% Quick Lime (SS Lime):	None	Tested By: PDD	



Method of Preparation D1557 - Soaked

Max. dry density (pcf) **127.5**
Opt. % m/c **8.6**

Before Soak	
Dry Density (pcf)	122.2
% m/c before compaction	10.9
% m/c after compaction	10.7

After Soak	
Dry Density (pcf)	122.5
% m/c top 1"	11.0
Average	10.8

CBR VALUE	
.100"	**4.3**
.200"	**5.9**

Swell % 0.0

Surcharge Wt.(lbs) 10

PLATE NO: B-11B

PARIKH CONSULTANTS, INC.

APPENDIX C

- Drilling Cuttings Characterization Report

December 5, 2011 TES Project No. 21513.001

Mr. Frank Li, Ph.D., P.E.
Parikh Consultants, Inc.
2360 Qume Drive, Suite A
San Jose, CA 95131

RE: Drill Cuttings Characterization
Six High Speed Train Drilling Locations
Golden State Boulevard
Fresno, California

Mr. Li:

In accordance with your request and authorization, Technicon Engineering Services, Inc. (Technicon) collected six (6) soil samples from drill cuttings at seven (7) drilling locations for disposal purposes.

Grab samples were collected and placed in an ice chest cooled with synthetic ice for delivery to a state-certified analytical laboratory for chemical analysis. The samples were subsequently analyzed for the presence and concentration of lead by EPA Method 6010 and polynuclear aromatic hydrocarbons (PAHs) by EPA Method 8310. Castle Analytical Laboratory in Atwater, California performed the laboratory analyses.

The results of the soil sample analyses are presented in Table 1. The laboratory analytical report and associated chain of custody record are also attached.

TABLE I
Soil Analytical Results
High Speed Train Drilling Locations
Drill Cutting Characterization
Samples collected November 2, 2011
Concentrations expressed in mg/kg (ppm)

ANALYTE	SAMPLE ID						REPORTING LIMIT
	1A	2A	3A	5A	8A	9A	
Lead	ND	26	8.3	13	7.0	11	5.0
	PAHS / PNAS						
Acenaphthene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Acenaphthylene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Anthracene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Benzo(a)anthracene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Benzo(a)pyrene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Benzo(b)fluoranthene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Benzo(g,h,i)perylene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Chrysene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Dibenzo(a,h)anthracene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Fluoranthene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Fluorene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Indeno(1,2,3-CD)pyrene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
1-Methylnaphthalene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
2-Methylnaphthalene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Naphthalene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Phenanthrene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005
Pyrene	ND	ND	ND<0.25	ND<0.50	ND	ND	0.005

mg/Kg (ppm) = milligrams per kilogram (parts per million)
ND = not detected above reporting limit

* Please refer to attached laboratory analytical report for full suite of analytes, reporting limits, practical quantitation limits, and dilution factors.

According to the analytical results, the metal lead was consistent with expected naturally occurring background levels of the soils in the vicinity of the source material.

Based on the analytical results of the soil samples collected and chemically analyzed for this investigation, it is Technicon's opinion that the concentrations of heavy metals detected in the soil samples do not warrant further investigation and that the soil requires no special handling.

This investigation was conducted in accordance with generally accepted industry standards. The performance of the investigation does not certify that the subject property is free of environmental impacts or hazardous materials. The conclusions presented herein are based on the observations and information gathered during our investigation.

We appreciate the opportunity to assist you. If you should have any questions or require additional information, please contact us at (559) 276-9311.

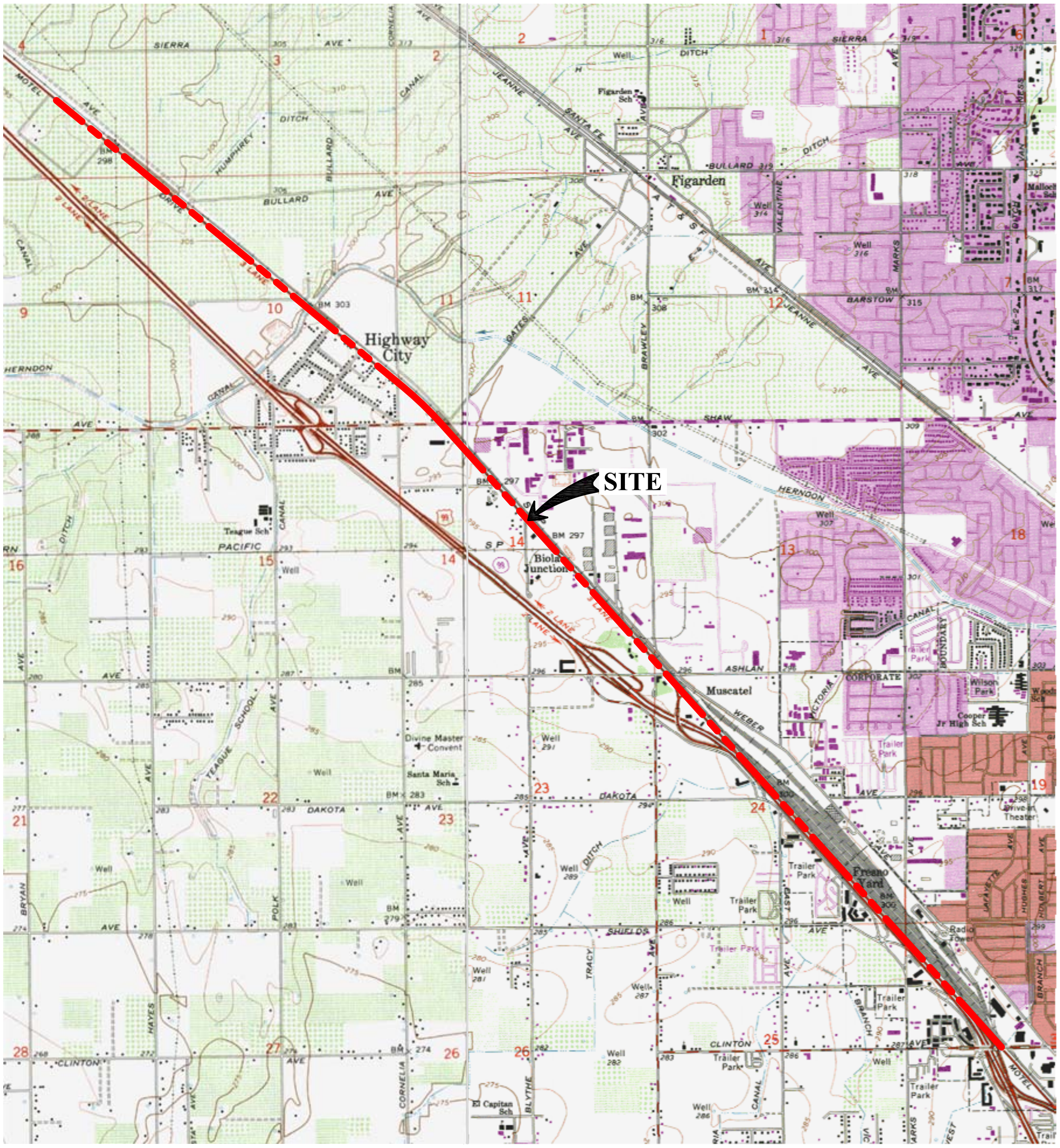
Respectfully submitted,
Technicon Engineering Services, Inc.

Charles Casey Barsamian
Environmental Specialist

PROFESSIONAL GEOLOGIST
STEVEN CURRA
No. 7172
12/31/11
STATE OF CALIFORNIA

Steve Curra, PG, REA II
Senior Geologist
Manager – Environmental Engineering Division

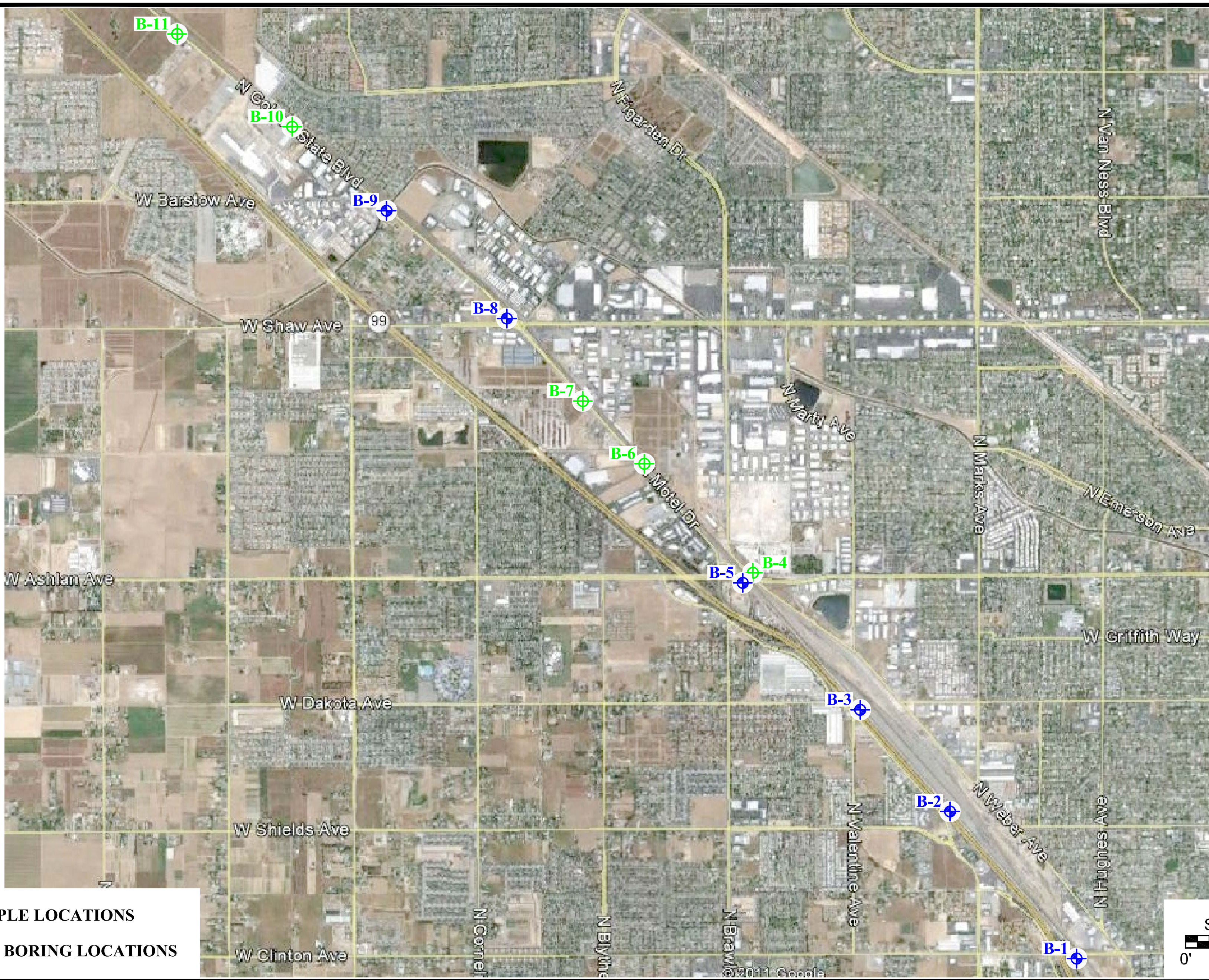
Attachments: Laboratory Analytical Report, Chain of Custody Record



USGS MAPS: HERNDON & FRESNO NORTH, DATES: 1964 & 1965, PHOTOS REV.: 1978 & 1981

TECHNICON ENGINEERING SERVICES, INC.

PROJECT: 21513	VICINITY MAP CALIFORNIA HIGH SPEED TRAIN CLINTON AVENUE TO VETERANS BOULEVARD FRESNO, CALIFORNIA	FIGURE	1
SOURCE: USGS TOPOGRAPHIC MAPS			NTS



B-9 =SAMPLE LOCATIONS

B-11 =SOIL BORING LOCATIONS

N

SCALE: 1"=30'

0' 15' 30'

TECHNICON ENGINEERING SERVICES, INC.	PROJECT: 21513	DATE: 12/05/11	SITE MAP CALIFORNIA HIGH SPEED TRAIN CLINTON AVENUE TO VETERANS BOULEVARD FRESNO, CALIFORNIA
	SOURCE: GOOGLE EARTH	APPROVED BY: CB	FIGURE 2

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Analytical Report

Castle Analytical Labs	Client Project ID: #1111023/21513-SC0	Date Sampled: 11/02/11
2333 Shuttle Drive Bldg 908/909		Date Received: 11/08/11
	Client Contact: Clari Cone	Date Reported: 11/14/11
Atwater, CA 95301	Client P.O.:	Date Completed: 11/11/11

WorkOrder: 1111277

November 14, 2011

Dear Clari:

Enclosed within are:

1) The results of the **6** analyzed samples from your project: **#1111023/21513-SC0,**
2) A QC report for the above samples,
3) A copy of the chain of custody, and
4) An invoice for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits.

If you have any questions or concerns, please feel free to give me a call. Thank you for choosing McCampbell Analytical Laboratories for your analytical needs.

Best regards,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

The analytical results relate only to the items tested.

SUBCONTRACT ORDER

Castle Analytical Laboratory

Project ID: 1111023 / 21513-SC0

1111277

SENDING LABORATORY:	**RECEIVING LABORATORY:**
Castle Analytical Laboratory	McCampbell Analytical, Inc.
2333 Shuttle Drive	1534 Willow Pass Road
Atwater, CA 95301	Pittsburg, CA 94565
Phone: 209.384.2930	Phone :(877) 252-9262
Fax: 209.384.1507	Fax: (925) 252-9269
Project Manager: Clari J. Cone	

Analysis	Expires	Comments
Sample ID: 1A (S000 1A) Soil	**Sampled: 11/02/11 09:00**	**Lab ID: 1111023-01**
PAHs	11/09/11 09:00	by EPA 8310
Lead - Total	04/30/12 09:00	by EPA 6010
Containers Supplied:		
01_Zip-Lock Bag (A)		
Sample ID: 2A (S000 2A) Soil	**Sampled: 11/02/11 09:15**	**Lab ID: 1111023-02**
PAHs	11/09/11 09:15	by EPA 8310
Lead - Total	04/30/12 09:15	by EPA 6010
Containers Supplied:		
01_Zip-Lock Bag (A)		
Sample ID: 3A (S000 3A) Soil	**Sampled: 11/02/11 09:30**	**Lab ID: 1111023-03**
PAHs	11/09/11 09:30	by EPA 8310
Lead - Total	04/30/12 09:30	by EPA 6010
Containers Supplied:		
01_Zip-Lock Bag (A)		
Sample ID: 5A (S000 5A) Soil	**Sampled: 11/02/11 10:00**	**Lab ID: 1111023-04**
PAHs	11/09/11 10:00	by EPA 8310
Lead - Total	04/30/12 10:00	by EPA 6010
Containers Supplied:		
01_Zip-Lock Bag (A)		

Released By	Date	Received By	Date
Clari Cone	11/7/11	Maria V.	11/8/11 0920

Released By / Date / Received By / Date

Page 1 of 2

SUBCONTRACT ORDER

Castle Analytical Laboratory

Project ID: 1111023 / 21513-SC0

Analysis	Expires	Comments
Sample ID: 8A (S000 8A) Soil	**Sampled: 11/02/11 10:15 Lab ID: 1111023-05**	
PAHs	11/09/11 10:15	by EPA 8310
Lead - Total	04/30/12 10:15	by EPA 6010
Containers Supplied: 01_Zip-Lock Bag (A)		
Sample ID: 9A (S000 9A) Soil	**Sampled: 11/02/11 10:30 Lab ID: 1111023-06**	
PAHs	11/09/11 10:30	by EPA 8310
Lead - Total	04/30/12 10:30	by EPA 6010
Containers Supplied: 01_Zip-Lock Bag (A)		

ICE/t° 5.2
GOOD CONDITION ✓ APPROPRIATE CONTAINERS ✓
HEAD SPACE ABSENT ___
DECHLORINATED IN LAB ___ PRESERVED IN LAB ___
PRESERVATION VOAS | O&G | METALS | OTHER

REC'D SEALED & INTACT VIA UPS

[signature]	11/7/11	[signature]	11/8/11 0920
Released By	Date	Received By	Date
Released By	Date	Received By	Date

Page 2 of 2

McCampbell Analytical, Inc.

1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1111277 **ClientCode: CALA**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Report to:

Clari Cone
Castle Analytical Labs
2333 Shuttle Drive Bldg 908/909
Atwater, CA 95301
(209) 384-2930 FAX: (209) 384-1507

Email: castlelab@vtlnet.com
cc:
PO:
ProjectNo: #1111023/21513-SC0

Bill to:

Accounts Payable
Castle Analytical Laboratory
2333 Shuttle Drive Bldg 908/909
Atwater, CA 95301

Requested TAT: **5 days**

Date Received: **11/08/2011**
Date Printed: **11/08/2011**

					Requested Tests (See legend below)											
Lab ID	**Client ID**	**Matrix**	**Collection Date**	**Hold**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1111277-001	1A (S000 1A)	Soil	11/2/2011 9:00	☐	A	A										
1111277-002	2A (S000 2A)	Soil	11/2/2011 9:15	☐	A	A										
1111277-003	3A (S000 3A)	Soil	11/2/2011 9:30	☐	A	A										
1111277-004	5A (S000 5A)	Soil	11/2/2011 10:00	☐	A	A										
1111277-005	8A (S000 8A)	Soil	11/2/2011 10:15	☐	A	A										
1111277-006	9A (S000 9A)	Soil	11/2/2011 10:30	☐	A	A										

Test Legend:

1	**8310_S**	**2**	**PB_S**	**3**		**4**		**5**	
6		**7**		**8**		**9**		**10**	
11		**12**							

Prepared by: Maria Venegas

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

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Sample Receipt Checklist

Client Name: **Castle Analytical Labs** Date and Time Received: **11/8/2011 9:34:27 AM**

Project Name: **#1111023/21513-SC0** Checklist completed and reviewed by: Maria Venegas

WorkOrder N°: **1111277** Matrix: Soil Carrier: UPS

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Sample IDs noted by Client on COC?	Yes ☑	No ☐	
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐	
Sampler's name noted on COC?	Yes ☐	No ☑	

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature	Cooler Temp: 5.2°C		NA ☐
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	No VOA vials submitted ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
Metal - pH acceptable upon receipt (pH<2)?	Yes ☐	No ☐	NA ☑
Samples Received on Ice?	Yes ☑	No ☐	

(Ice Type: BLUE ICE)

** NOTE: If the "No" box is checked, see comments below.*

Client contacted: Date contacted: Contacted by:

Comments:

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http://www.mccampbell.com / E-mail: main@mccampbell.com

Castle Analytical Labs 2333 Shuttle Drive Bldg 908/909 Atwater, CA 95301	Client Project ID: #1111023/21513-SC0	Date Sampled: 11/02/11
		Date Received: 11/08/11
	Client Contact: Clari Cone	Date Extracted: 11/10/11
	Client P.O.:	Date Analyzed: 11/10/11

Polynuclear Aromatic Hydrocarbons (PAHs / PNAs) by HPLC*

Extraction Method: SW3550C   Analytical Method: SW8310   Work Order: 1111277

Lab ID	1111277-001A	1111277-002A	1111277-003A	1111277-004A	Reporting Limit for DF =1	
Client ID	1A (S000 1A)	2A (S000 2A)	3A (S000 3A)	5A (S000 5A)		
Matrix	S	S	S	S		
DF	1	1	50	100	S	W
Compound	**Concentration**				mg/kg	ug/L
Acenaphthene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Acenaphthylene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Anthracene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Benzo (a) anthracene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Benzo (a) pyrene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Benzo (b) fluoranthene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Benzo (g,h,i) perylene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Benzo (k) fluoranthene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Chrysene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Dibenzo (a,h) anthracene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Fluoranthene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Fluorene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Indeno (1,2,3) pyrene	ND	ND	ND<0.25	ND<0.50	0.005	NA
1-Methylnaphthalene	ND	ND	ND<0.25	ND<0.50	0.005	NA
2-Methylnaphthalene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Naphthalene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Phenanthrene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Pyrene	ND	ND	ND<0.25	ND<0.50	0.005	NA
Surrogate Recoveries (%)						
%SS1	100	97	---#	---#		
%SS2	80	71	---#	---#		
Comments			a3	a3		

* water samples in µg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, product/oil/non-aqueous liquid samples and all TCLP & SPLP extracts are reported in mg/L.

ND means not detected above the reporting limit/method detection limit; N/A means analyte not applicable to this analysis; %SS = Percent Recovery of Surrogate Standard; DF = Dilution Factor

surrogate diluted out of range or surrogate coelutes with another peak.

a3) sample diluted due to high organic content.

DHS ELAP Certification 1644   Angela Rydelius, Lab Manager

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http://www.mccampbell.com / E-mail: main@mccampbell.com

Castle Analytical Labs 2333 Shuttle Drive Bldg 908/909 Atwater, CA 95301	Client Project ID: #1111023/21513-SC0	Date Sampled: 11/02/11 Date Received: 11/08/11
	Client Contact: Clari Cone	Date Extracted: 11/10/11
	Client P.O.:	Date Analyzed: 11/10/11

Polynuclear Aromatic Hydrocarbons (PAHs / PNAs) by HPLC*

Extraction Method: SW3550C   Analytical Method: SW8310   Work Order: 1111277

Lab ID	1111277-005A	1111277-006A			Reporting Limit for DF =1	
Client ID	8A (S000 8A)	9A (S000 9A)				
Matrix	S	S				
DF	1	1			S	W
Compound	**Concentration**				mg/kg	ug/L
Acenaphthene	ND	ND			0.005	NA
Acenaphthylene	ND	ND			0.005	NA
Anthracene	ND	ND			0.005	NA
Benzo (a) anthracene	ND	ND			0.005	NA
Benzo (a) pyrene	ND	ND			0.005	NA
Benzo (b) fluoranthene	ND	ND			0.005	NA
Benzo (g,h,i) perylene	ND	ND			0.005	NA
Benzo (k) fluoranthene	ND	ND			0.005	NA
Chrysene	ND	ND			0.005	NA
Dibenzo (a,h) anthracene	ND	ND			0.005	NA
Fluoranthene	ND	ND			0.005	NA
Fluorene	ND	ND			0.005	NA
Indeno (1,2,3) pyrene	ND	ND			0.005	NA
1-Methylnaphthalene	ND	ND			0.005	NA
2-Methylnaphthalene	ND	ND			0.005	NA
Naphthalene	ND	ND			0.005	NA
Phenanthrene	ND	ND			0.005	NA
Pyrene	ND	ND			0.005	NA
Surrogate Recoveries (%)						
%SS1	101	111				
%SS2	71	77				
Comments						

* water samples in µg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, product/oil/non-aqueous liquid samples and all TCLP & SPLP extracts are reported in mg/L.

ND means not detected above the reporting limit/method detection limit; N/A means analyte not applicable to this analysis; %SS = Percent Recovery of Surrogate Standard; DF = Dilution Factor

surrogate diluted out of range or surrogate coelutes with another peak.

a3) sample diluted due to high organic content.

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

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Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Castle Analytical Labs 2333 Shuttle Drive Bldg 908/909 Atwater, CA 95301	Client Project ID: #1111023/21513-SC0	Date Sampled: 11/02/11 Date Received: 11/08/11
	Client Contact: Clari Cone	Date Extracted: 11/08/11
	Client P.O.:	Date Analyzed: 11/09/11

Lead by ICP*

Extraction method: SW3050B　　Analytical methods: SW6010B　　Work Order: 1111277

Lab ID	Client ID	Matrix	Extraction Type	Lead	DF	% SS	Comments
1111277-001A	1A (S000 1A)	S	TOTAL	ND	1	108	
1111277-002A	2A (S000 2A)	S	TOTAL	26	1	112	
1111277-003A	3A (S000 3A)	S	TOTAL	8.3	1	107	
1111277-004A	5A (S000 5A)	S	TOTAL	13	1	101	
1111277-005A	8A (S000 8A)	S	TOTAL	7.0	1	108	
1111277-006A	9A (S000 9A)	S	TOTAL	11	1	112	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	TOTAL	NA	µg/L
	S	TOTAL	5.0	mg/Kg

*water samples are reported in µg/L, product/oil/non-aqueous liquid samples and all TCLP / STLC / DISTLC / SPLP extracts are reported in mg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, filter samples in µg/filter.

means surrogate diluted out of range; ND means not detected above the reporting limit/method detection limit; N/A means not applicable to this sample or instrument.

TOTAL = Hot acid digestion of a representative sample aliquot.
TRM = Total recoverable metals is the "direct analysis" of a sample aliquot taken from its acid-preserved container.
DISS = Dissolved metals by direct analysis of 0.45 µm filtered and acidified sample.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

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QC SUMMARY REPORT FOR SW8310

W.O. Sample Matrix: Soil QC Matrix: Soil BatchID: 62720 WorkOrder: 1111277

EPA Method: SW8310 **Extraction: SW3550C** **Spiked Sample ID: 1111277-006a**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/kg	mg/kg	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Benzo (a) pyrene	ND	0.015	114	106	7.47	110	113	2.91	80 - 120	20	80 - 120	20
Chrysene	ND	0.015	101	111	9.44	96.5	93.4	3.25	80 - 120	20	80 - 120	20
1-Methylnaphthalene	ND	0.015	101	99.3	1.50	98	104	6.16	80 - 120	20	80 - 120	20
2-Methylnaphthalene	ND	0.015	108	111	3.42	107	113	5.04	80 - 120	20	80 - 120	20
Phenanthrene	ND	0.015	96.6	98	1.43	93.9	102	7.95	80 - 120	20	80 - 120	20
Pyrene	ND	0.015	93.9	113	18.3	107	105	1.47	80 - 120	20	80 - 120	20
%SS1:	111	1	100	100	0	100	99	0.956	70 - 130	30	70 - 130	30
%SS2:	77	0.50	101	97	3.64	105	101	3.57	70 - 130	30	70 - 130	30

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 62720 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1111277-001A	11/02/11 9:00 AM	11/10/11	11/10/11 7:52 PM	1111277-002A	11/02/11 9:15 AM	11/10/11	11/10/11 7:18 PM
1111277-003A	11/02/11 9:30 AM	11/10/11	11/10/11 8:26 PM	1111277-004A	11/02/11 10:00 AM	11/10/11	11/10/11 9:00 PM
1111277-005A	11/02/11 10:15 AM	11/10/11	11/10/11 6:45 PM	1111277-006A	11/02/11 10:30 AM	11/10/11	11/10/11 5:03 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not enough sample to perform matrix spike and matrix spike duplicate or not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

Laboratory extraction solvents such as methylene chloride and acetone may occasionally appear in the method blank at low levels.

DHS ELAP Certification 1644 QA/QC Officer

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QC SUMMARY REPORT FOR 6010B

W.O. Sample Matrix: Soil | QC Matrix: Soil | WorkOrder: 1111277

EPA Method: SW6010B | **Extraction: SW3050B** | **BatchID: 62545** | **Spiked Sample ID: 1111249-002A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	Spiked	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	mg/Kg	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Lead	ND	50	101	94	7.43	10	106	113	6.86	75 - 125	25	75 - 125	25
%SS:	98	500	104	102	2.24	500	97	101	4.45	70 - 130	20	70 - 130	20

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 62545 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1111277-001A	11/02/11 9:00 AM	11/08/11	11/09/11 11:36 PM	1111277-002A	11/02/11 9:15 AM	11/08/11	11/09/11 11:38 PM
1111277-003A	11/02/11 9:30 AM	11/08/11	11/09/11 11:40 PM	1111277-004A	11/02/11 10:00 AM	11/08/11	11/09/11 11:43 PM
1111277-005A	11/02/11 10:15 AM	11/08/11	11/09/11 11:45 PM	1111277-006A	11/02/11 10:30 AM	11/08/11	11/09/11 11:47 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

DHS ELAP Certification 1644

QA/QC Officer

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City/State/ZIP: FRESNO CA 93722
Phone / FAX: 559 276-9311 / 559 276-9344
Proj # / P.O. # / Global ID: 21513
Report Attention: STEVE CURRA
Sampler Signature:
Printed: ASH JONES

Method of Shipment:

Notes:

REQUESTED ANALYSES

Lab ID#	SAMPLE ID	DATE	TIME	DESCRIPTION/LOCATION	SAMPLE TYPE (g) grab (c) composite (d) discrete	SAMPLE MATRIX (s) solid (l) liquid (o) other	BTEX/TPH-GAS	MTBE	TPH-DIESEL	TRPH 418.1M	Oxy's / EDB / DCA by 8260	8260	8310 PAH	6010 Pb			Electronic Deliverables (EDF)	NUMBER OF CONTAINERS	OBSERVATIONS/REMARKS
1111023-01	1A	900	11-2-11	S000 1A									X	X					
-02	2A	915		S000 2A									X	X					
-03	3A	930		S000 3A									X	X					
-04	5A	1000		S000 5A									X	X					
-05	8A	1015		S000 8A									X	X					
-06	9A	1030		S000 9A									X	X					

	Signature	Printed Name	Date	Time	Company Name
Relinquished by:	Ash Jones	ASH JONES	11/7/11	8:30	Technicon
Received by:	Clari Jcone	Clari Jcone	11/7/11	8:30	Castle Analytical
Relinquished by:					
Received by:					
Relinquished by:					
Received by:					

Total number of containers submitted to the laboratory

Note: All special requests (e.g. quick turn times) must be cleared through authorized laboratory personnel.

RESULTS DUE:
☐ VERBAL ☐ WRITTEN